# Sishen Iron Ore Company (Pty) Ltd: Sishen Iron Ore Mine

## SISHEN EXPANSION PROJECT

**Draft Environmental Impact Assessment Report and Environmental Management Programme Report**

Report date: 29 May 2023

Reference: NC30/5/1/2/3/2/1/259 MR/NC-00235MR/102

SHANGONI
Management Services (Pty) Ltd

Stewards

Problem Solvers

Team Players

*Influencing decisions since 2000 through identification, quantification and mitigation of environmental, safety, health and compliance risks*

# Executive summary

Sishen Iron Ore Company (Pty) Ltd ("SIOC"): Sishen Iron Ore Mine (Pty) Ltd ("SIOM") is operating under mining right number 259 MR. SIOM is in the process of expanding its mining activities.

Sishen Iron Ore Mine ("SIOM") has expanded its mining activities to the western side of the current mining pit area. This included the relocation of the Transnet railway line, Vaal-Gamagara pipeline and the relocation of the Dingleton town (2017). The second phase of the project involved expanding of the mining activities (2021) referred to as the Sishen Western Expansion Project ("SWEP") 5 project. Further to this, the expansion includes the pit expansion and various mining infrastructure (2022) "Sishen Expansion Project".

Orginally the Sishen Expansion Project at SIOM comprised of further pit expansions that include Far south pushback 21 and 19, Lylyveld pit expansion, C&G stockpile at Far south and Lylyveld pit, Moolmans workshop, access road and pollution control dam, proposed Far south Waste Rock Dump, heavy and light vehicle crossing, expansion of the existing tyre storage area, heavy mining equipment parkup area, proposed haul roads, and associated mining infrastructure, proposed rerouting of telephone line, powerline and pipelines.

However, due to project timelines associated with obtaining all applicable environmental authorisations, permits and licences for Pushback 21, a decision was made to exclude Pushback 21 and associated infrastructure (haul road, heavy mining equipment park up ("HME"), rerouted powerline, waterline and telephone line, C&G stockpile, associated waste rock dump and road crossing) from this Environmental Authorisation application, in consultation with the Department of Mineral Resources and Energy ("DMRE"). Further thereto, as the waste rock dump is excluded from this application, a waste management licence is no longer required. To this end, an updated Environmental Authorisation application was submitted to DMRE on 4 May 2023, with instruction from DMRE to continue with the EIA phase of the project.

The Sishen Expansion Project at SIOM now comprises of further pit expansions that include Far south pushback 19, Lylyveld pit expansion, C&G stockpile at Lylyveld pit, Moolmans workshop, access road and pollution control dam, expansion of the existing tyre storage area, heavy, proposed haul roads, and associated mining infrastructure.

SIOM must obtain several environmental authorisations. These include Environmental Authorisation from the Department of Mineral Resources and Energy ("DMRE"), and a Water Use Licence from the Department of Water and Sanitation ("DWS") as well as protected plant species permits from the Departments of Nature Conservation and Forestry ("DENC") and Department of Fisheries, Forestry and Environment ("DFFE").

The following listed activities are applied for:

| Listed activity | Activity description |
|---|---|
| **Listing Notice 1 (GNR 706 of GG 41766 of 13 July 2018)** | |
| Activity 12 | Pit Expansion area<br>Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>Haul roads |
| Activity 14 | Moolmans Maintenance Workshop, access road and proposed pollution control dam |
| Activity 19 | Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>Haul roads |
| Activity 24 | Haul roads |
| **Listing Notice 2 (GNR 325 of GG 40772 of 7 April 2017)** | |
| Activity 6 | Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>C&G stockpiles at Lylyveld |
| Activity 15 | Pit Expansion area<br>Pushback 19 Pit<br>Lylyveld pit expansion<br>Lyleveld pit C&G stockpile area<br>Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>Haul roads |
| **Listing Notice 3 (GNR 706 of GG 41766 of 13 July 2018)** | |
| Activity 12 | Pit Expansion area<br>Pushback 19 Pit<br>Lylyveld pit expansion<br>Lyleveld pit C&G stockpile area<br>Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>Haul roads |
| Activity 14 | Pit Expansion area<br>Moolmans Maintenance Workshop, access road and proposed pollution control dam<br>Haul roads |

# Table of Contents

# Annexures

Annexure E9: Noise Assessment

# References

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# Abbreviations

| | |
|---|---|
| **AIP** | Invasive Plant Species |
| **BIF** | Banded iron ore formation |
| **CA** | Competent Authority |
| **CBA** | Critical biodiversity areas |
| **DENC** | Departments of Nature Conservation and Forestry |
| **DFA** | Development Facilitation Act, 1995 (Act No. 67 of 1995) |
| **DFFE** | Department of Fisheries, Forestry and Environment |
| **DWS** | Department of Water and Sanitation |
| **DMRE** | Department of Mineral and Energy |
| **ESA** | **E**cological support area |
| **ESA** | Early Stone Age |
| **EIA** | Environmental Impact Assessments |
| **EA** | Environmental Authorisation |
| **ECI** | **E**lectrical, control and instrumentation |
| **EMP** | Environmental Management Programmes |
| **EIAR/EMPr** | Environmental Management Programme Report |
| **FEPA** | Freshwater Ecosystem Priority Area |
| **LM** | Gamagara Local Municipality |
| **GET** | Ground Engaging Tool |
| **HME** | Heavy Mining Equipment |
| **JTGDM** | John Taolo Gaetsewe District Municipality |
| **LSA** | Later Stone Age |
| **LDV** | Light delivery vehicle |
| **NEM:WA** | National Environmental Management Waste Act (Act No. 59 of 2008) |
| **NEMBA** | National Environmental Management: Biodiversity Act (No 10 of 2004) |
| **NCNCA** | Northern Cape Nature Conservation Act (No 9 of 2009) |
| **MAR** | Mean Annual Runoff |
| **MAMSL** | **M**etres above mean sea level |

| | |
|---|---|
| **MSA** | Middle Stone Age |
| **ONA** | Other natural area |
| **SCC** | Species of conservation concern |
| **S&EIR** | Scoping and Environmental Impact Assessment |
| **SLP** | Social and Labour Plan |
| **SIOC** | Sishen Iron Ore Company (Pty) Ltd |
| **SIOM** | Sishen Iron Ore Mine (Pty) Ltd |
| **SWEP** | Sishen Western Expansion Project |
| **VIA** | Visual Impact Assessments |
| **VU** | Vulnerable |
| **WML** | Waste Management License |
| **WUL** | Water use license |

# PART A

# SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

## 1 Details of project applicant and environmental assessment practitioner

### 1.1. Details of the project applicant

| | |
|---|---|
| **Name of operation** | Sishen Iron Ore Mine ("SIOM") |
| **Applicant** | Sishen Iron Ore Company (Pty) Ltd ("SIOC") |
| **Postal address** | Private Bag X506, Kathu, 8446 |
| **Responsible person** | Livhuwani Maemu |
| **Telephone no.** | 053 739 3001 |
| **e-mail address** | Sydron.Maemu@angloamerican.com |
| **Company registration no.** | 2000/011085/07 |

### 1.2. Details of the environmental assessment practitioner

| | |
|---|---|
| **EAP** | Shangoni Management Services (Pty) Ltd.: Lee-Anne Fellowes |
| **Tel No** | (012) 807 7036 |
| **Fax No** | (012) 807 1014 |
| **e-mail Address** | leeanne@shangoni.co.za |

### 1.3. Expertise of the environmental assessment practitioner

| Name and Surname | Qualifications and summary of experience |
|---|---|
| Lee-Anne Fellowes | Lee-Anne has a B-tech degree in Nature Conservation from the Tshwane University of Technology and holds a National Diploma in Nature Conservation. She gained valuable experience in the conservation and the environmental field through her employment at Gauteng's Department of Agriculture, Conservation and Environment for a period of 5 years. Her areas of expertise include alien invasive surveys, biodiversity action & conservation plans, Environmental Impact Assessments ("EIA"), Environmental Management Programmes ("EMP"), Section 24G Rectification Applications, Basic Assessments, Water Use Licenses and Project Management. Lee-Anne has 17 years' experience at Shangoni Management Services. Lee-Anne has been registered as a Professional Natural Scientist in the field of Conservation Science Registration number: |

| Name and Surname | Qualifications and summary of experience |
|---|---|
| | 115574 and is registered as an environmental impact assessment practitioner Registration number: 2019/850. Lee-Anne is currently serving on the Gauteng's Department of Agriculture and Rural Development Appeals Panel Committee for a period of 36 months (2020 – 2023). |

# 2 Description of the property

The Sishen Expansion Project is located 8 km south-east from Kathu. Refer to Figure 1.

For the affected properties refer to Table 1,

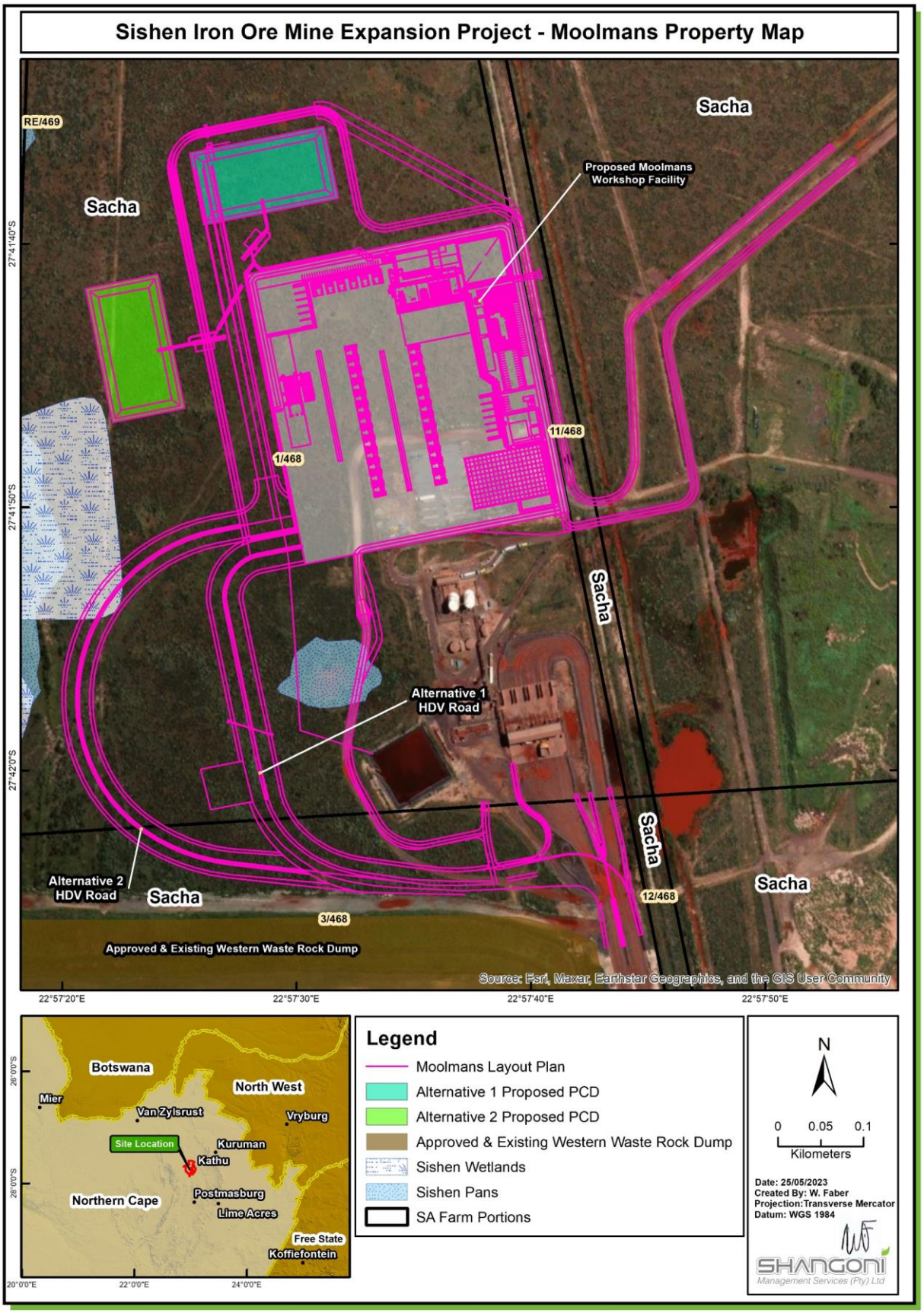


*Figure 2: Affected properties associated with the Moolmans workshop area*

, Figure 3, Figure 4,

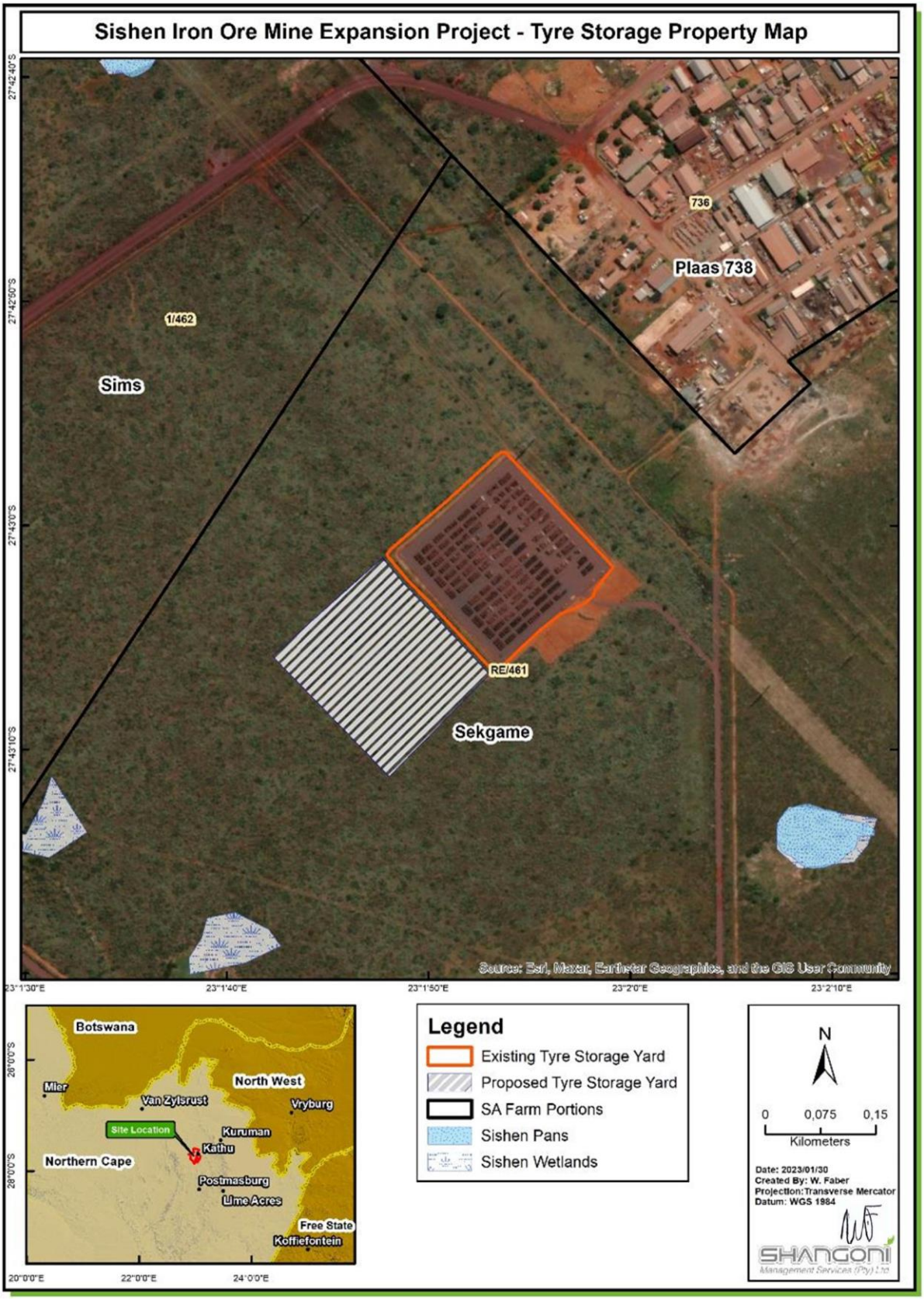


Figure 5 and Figure 6.

*Table 1: Affected properties*

| | | |
|---|---|---|
| | **Pit Expansion area**<br>Remaining extent and portion 5 of the farm Bruce 544 and Dingleton erf 571 – 678, portions 1, 2, 3, 4, 8, 9, 12 and 13 of Gamagara 541, portions 2,3 ,4 and 13 of the farm Sacha 486. Portion 1 of the farm Sims 462. Remaining extent, portion 1, 2, 16, 19 ,21 and 22 of the farm Sishen 543. | **Pushback 19 Pit**<br>Portion 1, 2, 19 and 22 of the farm Sishen 543 |
| | **Lylyveld pit**<br>Remaining extent of Lylyveld 545 | **Haul roads**<br>Portion 2 of the farm Gamagara 541 |
| | **C&G stockpile area**<br>Remaining extent of Lylyveld 545 | **Tyre Storage Yard**<br>Remaining extent of the farm Sekgame 461 |
| | **Moolmans Maintenance Workshop, access road and proposed pollution control dam**<br>Portion 1, 3 and 11 of the farm Sacha 468 | |
| **Magisterial district** | Gamagara Local Municipality, John Taolo Gaetsewe District Municipality | |
| **Distance and direction from nearest town** | 8 km south-east from Kathu | |

| | | |
|---|---|---|
| | **Pit Expansion area**<br>C04100000000046200001<br>C04100000000046800002<br>C04100000000046800003<br>C04100000000046800004<br>C04100000000046800013<br>C04100000000054100001<br>C04100000000054100002<br>C04100000000054100003<br>C04100000000054100004<br>C04100000000054100008<br>C04100000000054100009<br>C04100000000054100012<br>C04100000000054100013<br>C04100000000054300000<br>C04100000000054300001<br>C04100000000054300002<br>C04100000000154300016<br>C04100000000154300019<br>C04100000000154300021<br>C04100000000154300022<br>C04100000000054400001<br>C04100000000054400005<br>C04100060000057100000 - C04100060000067800000 | **Haul roads**<br>C04100000000054100002 |
| | **Pushback 19 Pit**<br>C04100000000054300001 | **Tyre Storage Yard**<br>C04100000000046100000 |
| | **Lylyveld pit**<br>C04100000000054500000 | **Lyleveld C&G stockpile area**<br>C04100000000054500000 |
| | **Moolmans Maintenance Workshop, access road and proposed pollution control dam**<br>C04100000000046800001<br>C04100000000046800003<br>C04100000000046800011 | |

# 3 Locality of the project

Sishen Iron Ore Mine ("SIOM") falls within the administrative boundaries presented in Table 2.

*Table 2: Administrative boundaries*

| | |
|---|---|
| **Province** | Northern Cape Province |
| **District municipality** | John Taolo Gaetsewe District Municipality |
| **Local municipality** | Gamagara Local Municipality |
| **Department of Mineral and Energy ("DMRE") Local Office and the Competent Authority ("CA")** | DMRE (Kimberley) |
| **Department of Water and Sanitation ("DWS") Local Office** | DWS (Kimberley) |
| **Department of Environmental Affairs and Nature Conservation ("DENC")** | DENC (Kimberley) |
| **Catchment zone** | Orange River Catchment |
| **Sub-catchments** | D4 |
| **Water Management Area ("CMA")** | Lower Vaal |
| **Quaternary catchment** | D41J |

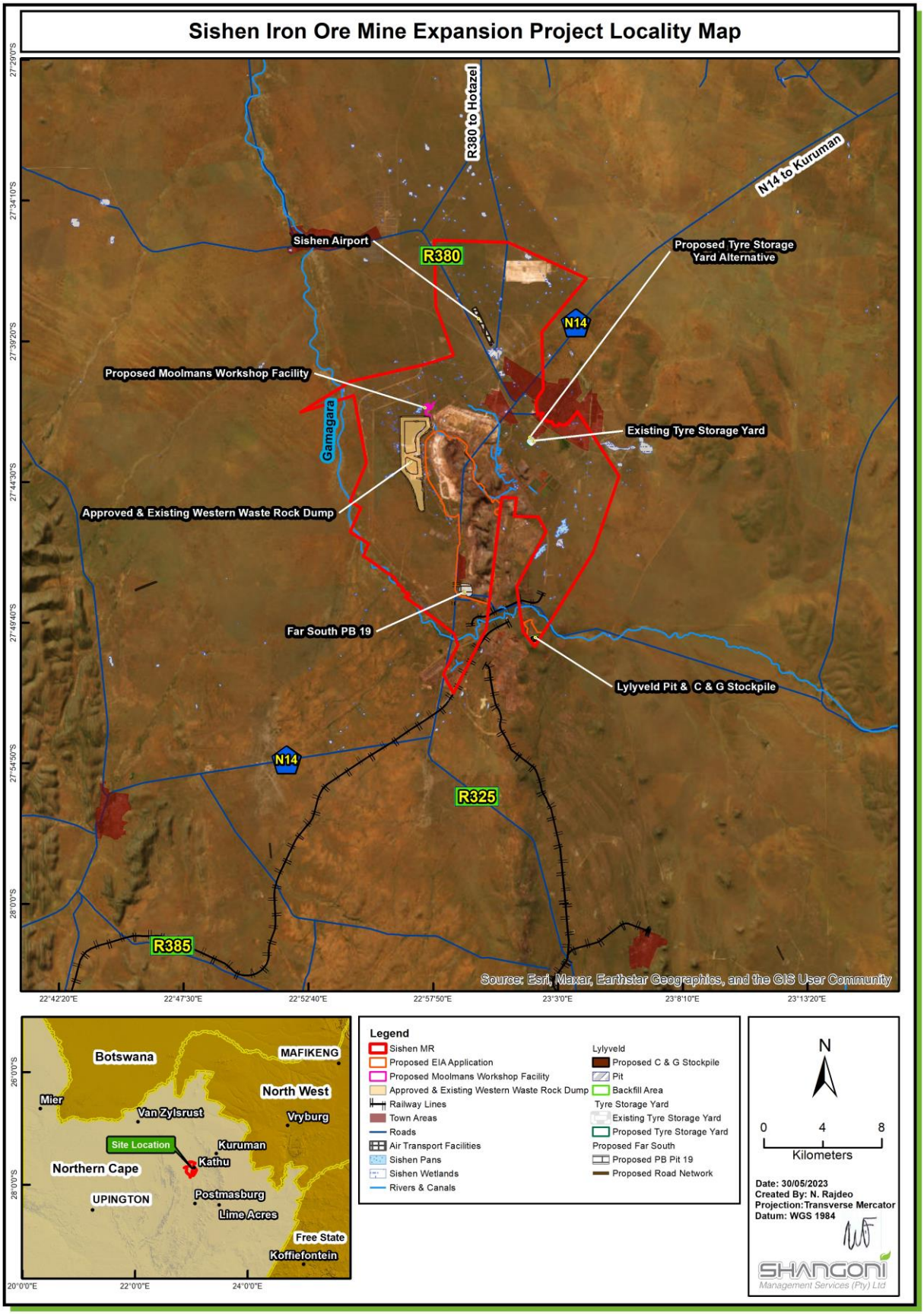


*Figure 1:Locality map*

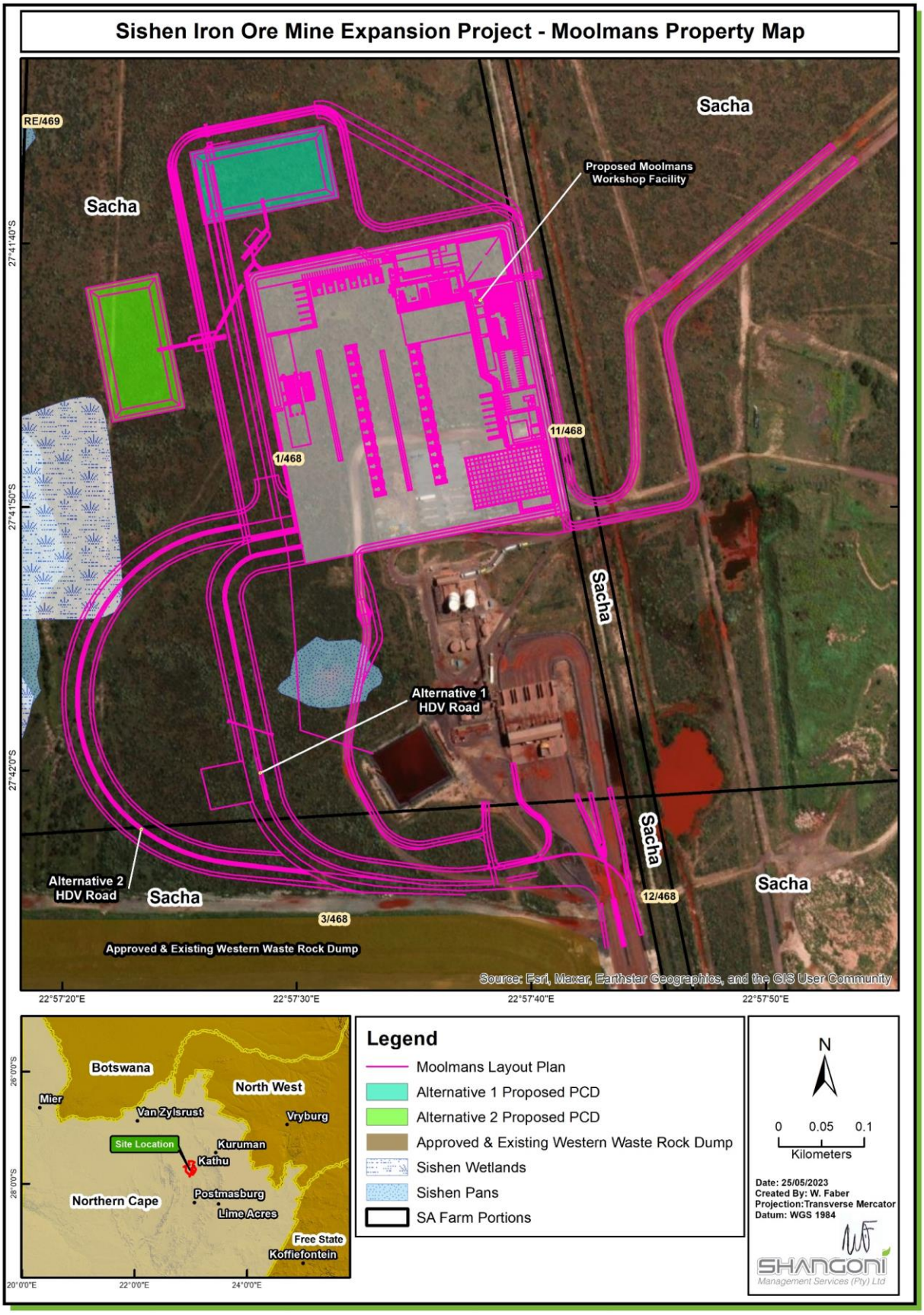


*Figure 2: Affected properties associated with the Moolmans workshop area*

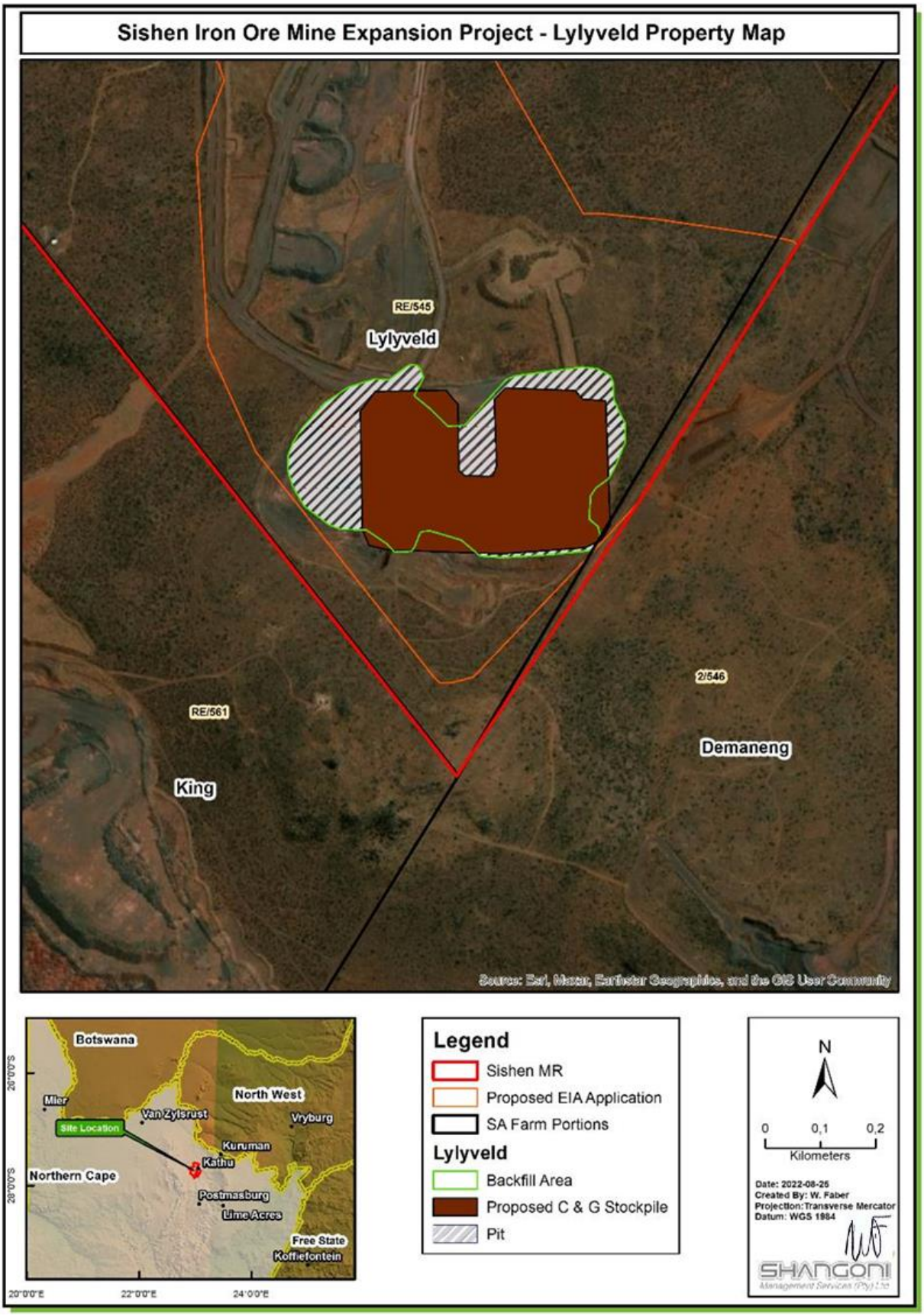


*Figure 3: Affected properties associated with the Lylyveld Pit*

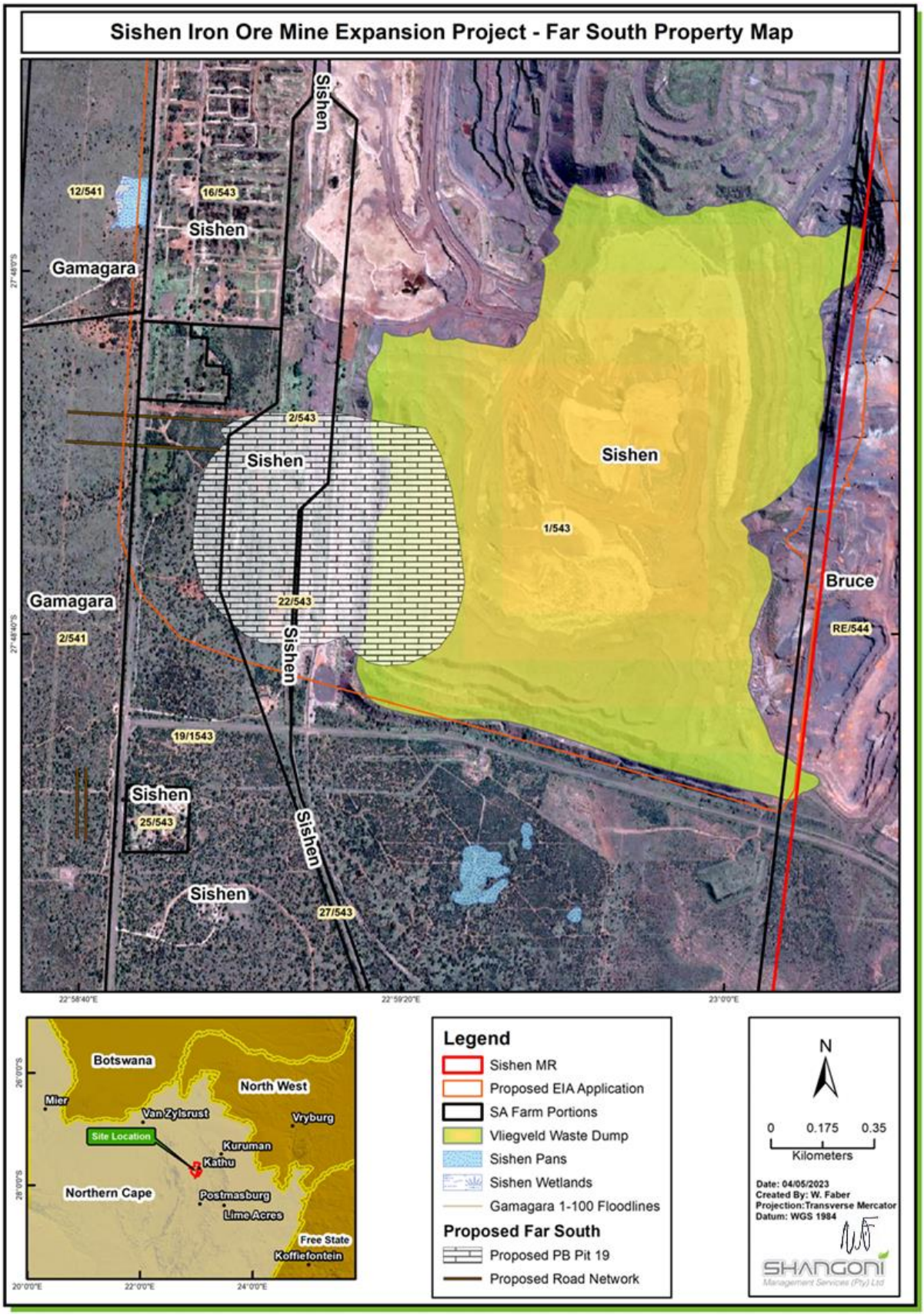


*Figure 4: Affected properties associated with the southern section of the project*

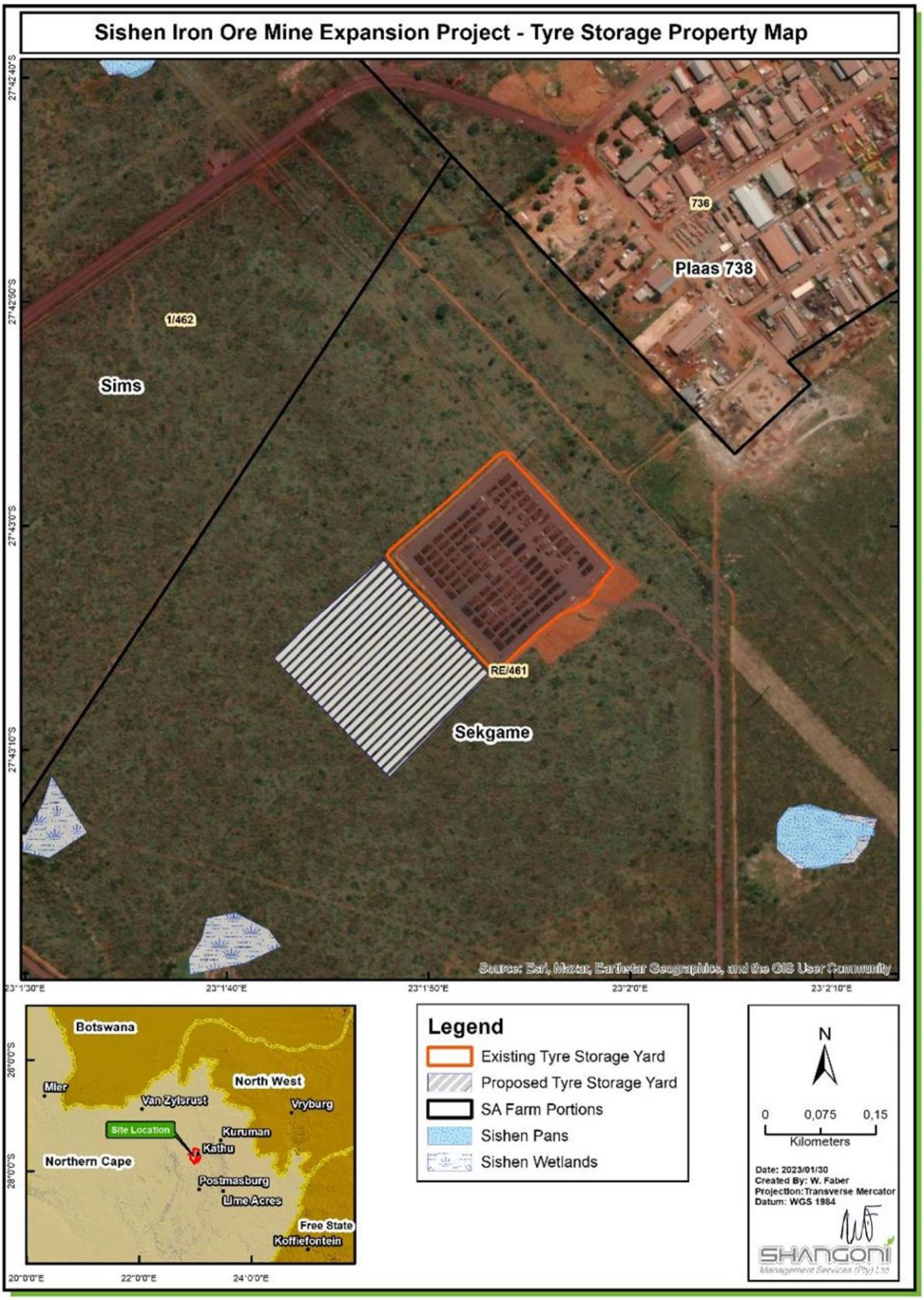


*Figure 5: Affected properties associated with the Tyre Storage and expansion area*

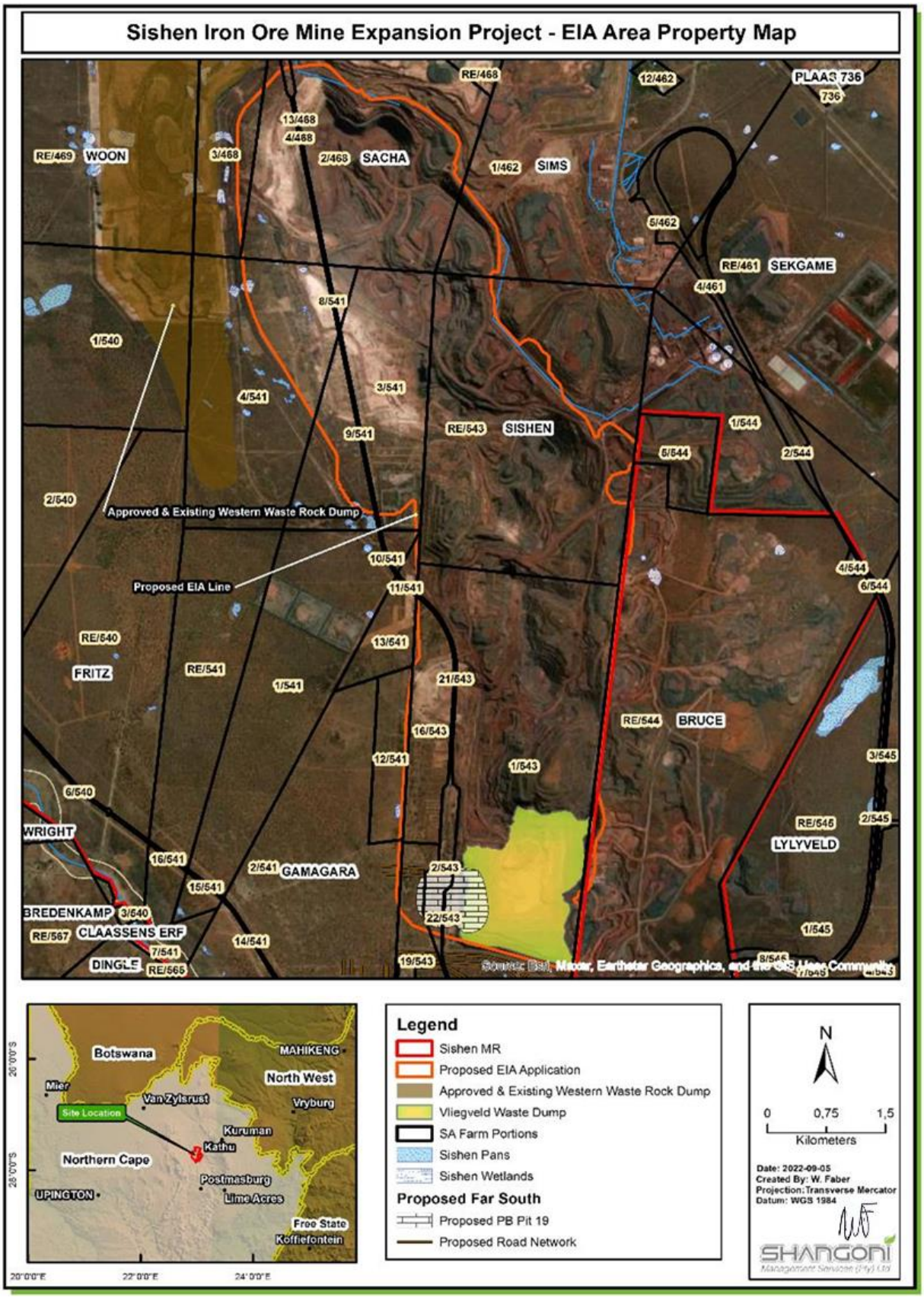


*Figure 6: Affected properties associated with the pit expansion*

# 4 Description of the scope of the proposed activities

SIOM has expanded its mining activities to the western side of the current mining pit area. This included the relocation of the Transnet railway line, Vaal-Gamagara pipeline and the relocation of the Dingleton town (2017). The second phase of the project involved expanding of the mining activities (2021) referred to as the Sishen Western Expansion Project ("SWEP") 5 project. Further to this, the expansion includes the pit expansion and various mining infrastructure (2022) "Sishen Expansion Project".

## 4.1 Description of the proposed activities to be undertaken

The proposed Sishen Expansion Project at SIOM comprises of further pit expansions that include Far south pushback 19, Lylyveld pit expansion, C&G stockpile at Lylyveld pit, Moolmans workshop, access road and pollution control dam, expansion of the existing tyre storage area, proposed haul roads.

Sishen must obtain several environmental authorisations. These include Environmental Authorisation from the Department of Mineral Resources and Energy ("DMRE"), and a Water Use Licence from the Department of Water and Sanitation ("DWS") as well as protected plant species permits from the Departments of Nature Conservation and Forestry ("DENC") and Department of Fisheries, Forestry and Environment ("DFFE").

The following activities are proposed:

**Pit Expansion (40 ha)**

The mine planners have identified several areas where the pit boundary expands over the next few years. Refer to Figure 7 for the proposed EIA application area appliable to the pit expansion (outlined in orange). As part of the pit expansion this includes Pushback 19 Pit (15 ha). The Pushback 19 pit was assessed and approved in the 2019 EIA/EMP as a dump. Approval is required for the establishment of a pit. A road is proposed to access PB 19.

**Lylyveld pit (110 ha)**

Expansion of the current approved pit 15 ha (2017). No new infrastructure is proposed. It is proposed the C&G stockpile will be located within the existing pit. The proposed stockpile can include other material stockpiles such as A grade and JIG material.

**Moolmans Maintenance Workshop (6.5 ha)**

A new workshop is planned close to the Nooitgedacht filling station and includes the following:

<u>Workshop Facilities</u>

- Requirement for the Moolmans Workshop Facilities Washbay and Separation Plant
    - Four light delivery vehicle ("LDV") Service Bays;
    - Ground Engaging Tool ("GET") Yard;
    - Store and delivery area;
    - Two Boiler shop;

- Four Heavy Mining Equipment ("HME") Service bays;
- 45 tonnes Overhead Crane
- Service lube containers (approximately 200 $m^3$);
- Store with office;
- Oil handing storage facility;
- Support Equipment Service Bay; and
- Two 10 kilo litre water tanks and pump system.

- Ramps at all entrances as per design.

<u>Wash bay and separation plant</u>

The following facilities are required:

- HME Wash Bay;
- Machinery Wash Bay;
- Separation Plant:
- Silt Trap; and
- Oil/water separator.

<u>Wash bay for HME</u>

- An HME Wash Bay is required. This must include:
  - Pumps;
  - HME Wash Bay:
  - Two High Volume nozzles; and
  - Two High Pressure Low Volume nozzles.
  - Sumps;
  - Water tank or water feed;
  - Concrete floor;
  - High walls to prevent overspray; and
  - Oil/water separator.
- The Wash Bay floor must be rated to accommodate a Caterpillar 789D Haul Truck. Wash bay must have a slope of 1:100 to the waste-water canal. Floor must be designed to prevent any slippage. Drainage must be provided to the Silt trap. Stop blocks must be installed to prevent an incident in the case of vehicle slipping on slit in the wash bay.

<u>Wash bay for support machinery and LDV's</u>

- A support equipment Wash Bay is required. This must include:
  - Pumps;
  - Support Equipment Wash Bay;
  - Two High Volume Nozzles;
  - Sumps;
  - Water tank or water feed;

- Concrete floor;
- High walls to prevent overspray; and
- Oil/water separator

- The Wash Bay floor must be rated to accommodate LDV's and Support Machinery being serviced. Wash bay must have a slope of 1:100 to the wastewater canal. Floor must be designed to prevent any slippage. Drainage must be provided to the Silt trap. Stop blocks must be installed to prevent an incident in the case of vehicle slipping on slit in the wash bay.

Sump and Silt Trap

The sump and the silt trap must be sized for easy removal of silt from the silt trap as per standard design.

LDV Service Bays

- Four LDV service bays
  - Each service bay must slope towards the drain between the LDV and HME work areas; and
  - Each LDV service bay must be able to close with a roller door five metre high and four metre wide.
- An access door leading from the LDV Workshop to the HME Workshop area.

Ground Engaging Tool ("GET") Yard

Secured storage area where bigger components can be stored. The area must be fenced with two double lockable swing gates on both sides. (50 m x 50 m).

Get Yard Floor

The GET Yard should have a concrete base floor for all the equipment that should be stored in the area.

Boiler Shop

- The following requirement for the boiler shop:
  - One Boiler shop (open service bay) in line with the HME service bays:
  - Drainage needs to be provided in front of the boiler shop; and
  - Overhead crane from the HME service bays needs to extend over the boiler shop service area.
  - Lockup boiler shop with three roller doors, with a clear opening of five metre high and four metre wide, leading into this area:
  - Two Roller doors must be between the boiler shop service bay; and
  - The third roller door must be from the outside of the building.
- A service door is required next to the roller door.

HME Service Bays

- The HME Service Bay requirements:
  - Four HME service bays are required;

- HME service bays floor must slope to a drain down the centre of the building draining to the silt trap;
- Stop blocks in the front of each HME service bay;
- Clear opening of ten metre wide, and 14.2 metre high and 23.5 metre length is required for each HME service bay (17 metre clearance for truck, 4.5-meter service area clearance and walkways and two metre for support equipment and tools);
- A 1 metre clearance on all sides of haul truck in the service area;
- Overhead crane across all the HME service bays and the unclosed boiler shop;
- Crane needs to clear a Haul Truck with one metre when body is raised;
- The last HME service bay next to the open boiler shop floor must be reinforced with steel railway tracks to prevent damage to the floor when equipment fitted with steel tracks are serviced;
- A 40-metre clearance will be required in front of the HME Service bays to ensure safe turning circle for HME haul trucks; and
- A sufficient number of lube dispensing points, at each unit, must be provided for different types of lube and grease used at the workshop. At least the same number of lube points as with the existing HME Workshop must be provided.

HME Workshop entrance doors

PVC Maxiflex type Mega door type and not steel roll up doors is preferred to close the HME Workshop area from external elements.

Overhead Crane

A 45-tonne overhead crane is required to operate across all HME work areas as well as the open Boiler shop. The hoist of the overhead crane need to clear the HME haul truck open body with a minimum of one metre. The size of the crane to be specified by the Design Engineer.

Service Lube Container

A 12-metre service lube container, standard height on the side of the building. Container must be on a concrete floor base with a slope for draining fluids to the slit trap. The service lube container must have a roof covering. If there is not sufficient space at the lubrication farm, this must be accommodated on the other side of the building.

Store with Office

- A lockable storeroom with the following:
  - Office area in the storeroom;
  - Serving hatch that leads into the LDV workshop area. A serving counter at 1100 mm from the floor. The door opening must be two metre wide and 1.1 metre height from the serving counter;
  - A lockable entrance door from the LDV service area;
  - The height of the floor between the store room and LDV workshop should be on the same level at the door leading to the LDV workshop; and
  - A delivery roller door from the outside of the stoor with a clear opening of four metres wide and five metres high.

- An outside entrance door next to the delivery roller door for access into the storeroom.

Store Room

The store room should be high enough to accommodate double volume (level) storage.

Store Delivery Area

A dedicated delivery area with a concrete slab in front of the delivery door at the store for offloading.

Oil Handling Storage Facility

- A 12-metre oil handling and storage container, standard height on the side of the building;
- A drain needs to be installed from the container to the oil separation plant; and
- If there is insufficient space at the lubrication farm, this must be accommodated on the other side of the building.

Machinery (2628) Service Bay

- Machinery/Support Equipment (2628) service bay
- Machinery service bay must slope towards the drain between the machinery and HME work areas;
- Machinery service bay must be able to close with a roller door (4 metre in width and 5 metre in height); and
- A 25-metre clearance will be required in front of the HME Service bays to ensure safe turning circle for support equipment and LDV's.

Water Tanks and Pump System

- The following water tank requirements:
    - Two 10 000 litre JoJo water tanks; and
    - Pressure pumps to supply sufficient pressure to accommodate services intended for.
    - Water feed and connection points in the workshop area for cleaning.

Admin Office Toilet/ Washroom Facilities

- Separate toilet facilities to be provided for 15 males and 17 females.

Office Blocks

The office block requirement for the Administration, GCC Plant and Production offices and administration:

- Five single management offices;
- 5 x 2 desk offices;
- 1 x 4 desk office;
- 10 – 12 seat Boardroom;
- Separate toilet facilities for male and female (15 Male and 17 Female); and
- Kitchenette facility.
- GCC Plant:
    - 8 x Single offices;
    - 2 x 4 desk office;

- 1 x 2 desk office;
- 12 seat Boardroom with 15 additional chairs;
- Filing Office;
- Ablution
  - Separate toilet and shower facilities for male and female (45 male and 5 female);
  - Separate change rooms (45 male and 5 female);
  - Accommodate 115 lockers (105 lockers in male change room and 10 lockers in female change room);
- Kitchenette facility; and
- Training room for 30 people.

- Production:
  - 5 x single desk offices;
  - 3 x 2 desk offices; and
  - 1 x Control Room;
- Ablution:
  - Separate toilet facilities for male and female (65 male and 15 female);
  - Separate change rooms (65 male and 15 female);
  - Accommodate 80 lockers (65 male and 10 female);
  - Kitchenette facility; and
  - Training room for 10 people.

Support Equipment Parking Bays

Parking Bays for all support equipment.

Designated Maintenance Areas

All maintenance of machineries need to take place within designated workshop structures.

Simulator Area

A designated area is required for the training simulator. It is a 6m x 3m container that will require undercover parking. The area must be either close to the production area or at the offices.

External Maintenance Service Bay

- An open area must be provided for shovel and HME rebuild work in instances when it is not feasible to be done inside the workshop. The requirements for the facilities are:
- An area of 160 m long and 45 m wide is required for Haul Truck and support equipment services that takes longer than 24 hrs to complete;
- The areas must include sufficient control, such as HDPE lining and sacrificial layer, to prevent ground and groundwater pollution due to oil spillages; and

- The measurements above includes a service road area for LDV's and support equipment for maintenance tasks. The service road is to separate man and machine during maintenance activities.

Waste Bin Area

- A designated waste bin area must be provided;
- The area must be separated from pedestrians and HME and easily accessible for artisans to dump waste through manual handling or with trollies;
- It must also be easily accessible for waste bin trucks when collecting the full bins;
- The approximate area required for the waste bins is 8 metres (w) and 18 metres (l); and
- Sufficient space is required in front of the containers for the on- and off-loading of containers.

Shift Change Rooms / HME Park Area

Shift change rooms to be as close as possible to the HME park up area for shift workers.

Existing Wash Bay at HME Workshops

The wash bay at the HME workshop is currently contracted out. If a decision is made to consolidate services at the wash bay the contract needs to be renegotiated.

HME Workshop Wash Bay Clearance

A 50-metre entry and exit clearance is required at the existing wash bay used by LOM.

Tyre Bay At HME Workshops

The tyre bay at the HME Workshop needs to accommodate two HME's at any one time.

Wash Bay, Tyre Workshop and Tyre Pump Station Location

From a management perspective it is advisable that the entire Moolmans facilities (all structures) requirement be within walking distance from each other.

Water Management at Moolmans Facilities

A water management system needs to be put in place to prevent water from pooling in the area.

Water Management around buildings

A water management system needs to be installed around all permanent and semi-permanent building to prevent water from pooling. Sufficient water canals must be installed to prevent flooding.

Designated Maintenance Areas

Designated maintenance areas, excluding the workshop, are required for long term maintenance. It does not require a structure but needs to be in close proximity of the workshop.

Shift Toilet and Shower Facilities

Separate toilet and shower facilities for male and female Shift personnel adjacent to the shift change rooms.

Caucus Rooms

Shift change rooms to accommodate shift changes and caucus meetings for 60 personnel. The shift change room must be able to accommodate 50 Male and 10 Female locker facilities. It is suggested that the Shift change room be accommodated close to where the change rooms were.

Wash Bay Water Containment

The Wash Bay must be provided with a small canal and sufficient apron to contain the water and prevent the development of a wet and muddy area in front of the Wash Bay.

Container Storage Area

Containerised storage area.

Boiler Shop Storage Area

The Boiler shop requires an outside storage area of approximately 8 x 20 metres, close to the boiler workshop, for materials and storing equipment.

Water Supply

A suitable wash water supply line must be established for the proposed Moolmans Workshop Facilities area for maintenance and cleaning purposes.

Electrical Infrastructure

The design of all electrical, control and instrumentation ("ECI") infrastructure for all facilities created by this project and all associated activities such as site visits, site investigations & measurement activities, e.g., Soil Resistivity Surveys, etc.

The design scope typically includes the following:

- Developing equipment lists;
- Developing load lists;
- Determining required Maximum Demand;
- Identify power supply sources;
- Evaluate adequacy of supply sources;
- Power supply & reticulation design (to be integrated into existing infrastructure for supply of electricity);
- Interior & Exterior Illumination design;
- Soil Resistivity Surveys for Earthing & Lightning Protection if required in the absence of previous survey result reports;
- Earthing & Lightning Protection Design (Lightning Protection Design Certificate to be Issued as per applicable SANS);
- Develop all relevant investigation and design documentation, i.e., Concept Report, Feasibility Report, Detailed Design Report, Illumination Design Report, Complete Infrastructure Drawings;
- Verify or Develop (responsibility to be clarified by project manager) bill of quantities for full detailed equipment and material specification;

- Develop Scopes of Work and supply all drawings and other relevant documentation for all Installation Work Packages; and
- Site Monitoring of contractors and facilitation of commissioning activities.

**Tyre Storage Yard (4.5 ha)**

Expansion of the current Tyre Storage Yard. Proposed expansion to the west and alterative to the north of the Existing Tyre Storage Yard.

## 4.2 Listed and specified activities applied for

The Sishen Expansion Project will trigger the following authorisations:

- An Environmental Authorisation ("EA") for listed activities contained in the Environmental Impact Assessment Regulations Listing Notices of 2014, as amended, and published in terms of sections 24(2), 24 (5), 24D, 44 and 47(A) (1) (b) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA").

For the EA a Scoping and Environmental Impact Assessment ("S&EIR") will be conducted in accordance with the NEMA and the Environmental Impact Assessment Regulations, 2014 (GN R982 of 4 December 2014) ("GN R982"), as amended. Listed activities have been identified and provided in Table 3.

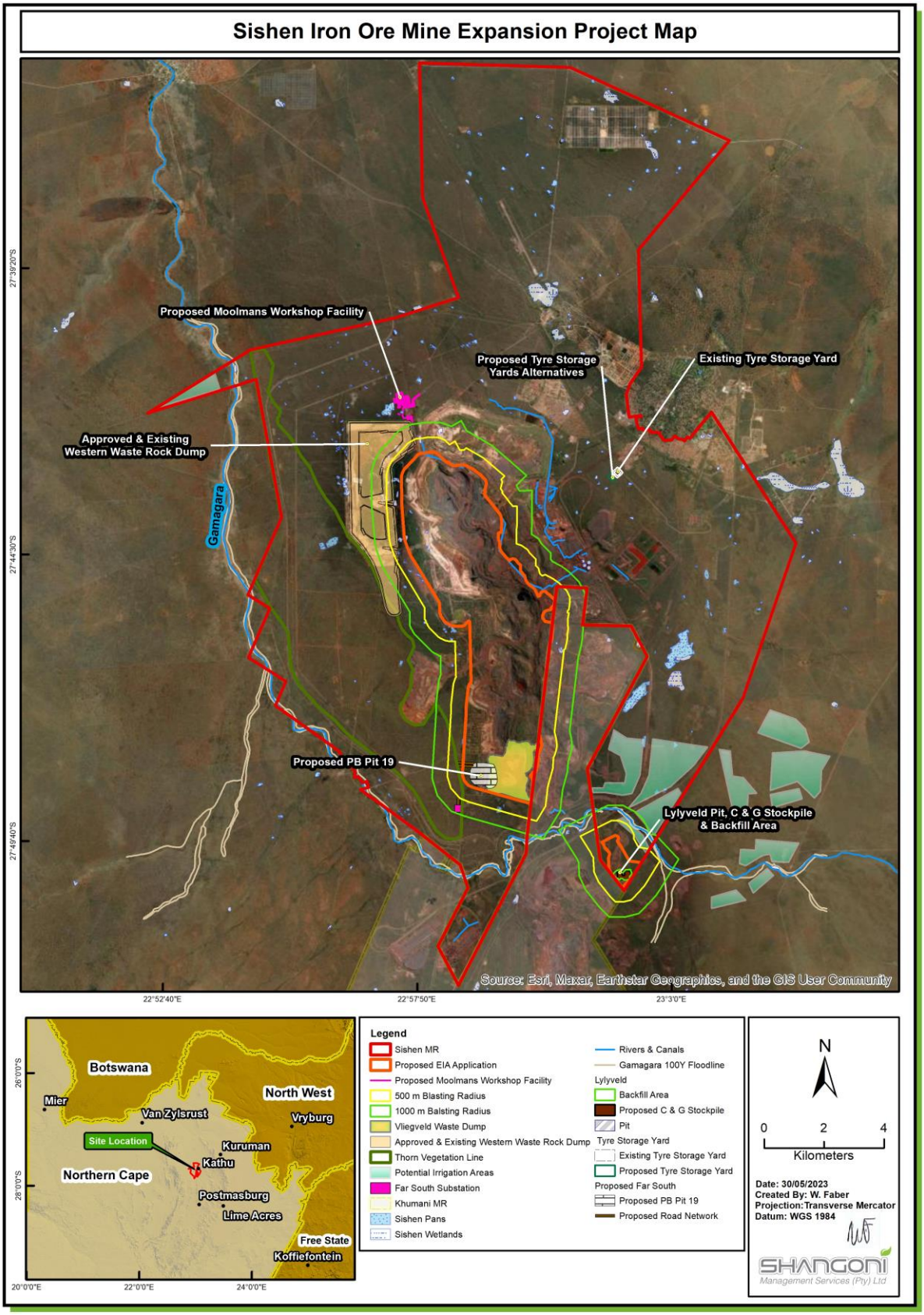


*Figure 7: Layout Map of the proposed activities associated with the Sishen Expansion Project*

*Table 3: Activities and listed activities associated with the Sishen Expansion Project*

| Name of Activity | Arial Extent of Activity Ha or m² | Listed Activity (Mark with X) | Applicable Listing Notice (GN R983, GN R984, GN R985) |
|---|---|---|---|
| **Site clearing of the footprint areas of the facilities** | | | |
| Pit Expansion area | 40 ha | X | Activity 15 of Listing Notice 2 (GNR 984 of GG 40772 of 7 April 2017):<br>*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—*<br>*(i) the undertaking of a linear activity; or*<br>*(ii)maintenance purposes undertaken in accordance with a maintenance management plan.*<br>Activity 12 of Listing Notice 3 (GNR 985 of GG 40772 of 7 April 2017):<br>*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* |
| Pushback 19 Pit | 15 ha | | |
| Lylyveld pit including the C&G stockpile | 110 ha | | |
| Moolmans Maintenance Workshop, access road and proposed pollution control dam | 14.5 ha | | |
| Expansion of existing Tyre Storage Yard | 4.5 ha | | |
| Haul roads | 9 ha | | |
| **Construction and utilisation of the facilities** | | | |
| EIA application area | 47 ha | X | Activity 12 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 100 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*<br>Activity 19 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.*<br>Activity 14 of Listing Notice 3 (GNR 985 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 10 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* |
| Pit Expansion area | 40 ha | X | Activity 12 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 100 square metres or more;*<br>*where such development occurs—* |

| Name of Activity | Arial Extent of Activity Ha or m² | Listed Activity (Mark with X) | Applicable Listing Notice (GN R983, GN R984, GN R985) |
|---|---|---|---|
| | | | *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*<br>Activity 14 of Listing Notice 3 (GNR 985 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 10 square metres or more;*<br>*where such development occurs—*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* |
| Pushback 19 Pit | 15 ha | | None identified. |
| Lylyveld pit including the C&G stockpile | 110 ha | | None identified. |
| Moolmans Maintenance Workshop access road and pollution control dam | 6.5 ha | | Activity 12 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 100 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*<br>Activity 14 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*<br>Activity 19 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.*<br>Activity 14 of Listing Notice 3 (GNR 985 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 10 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*<br>Activity 6 of Listing Notice 2 (GNR 984 of GG 40772 of April 2019):<br>*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.* |

| Name of Activity | Arial Extent of Activity Ha or m² | Listed Activity (Mark with X) | Applicable Listing Notice (GN R983, GN R984, GN R985) |
|---|---|---|---|
| Expansion of the existing Tyre Storage Yard | 4.5 ha | | Category C: Activity 3 (GNR 921 of GG37083):<br>No listed activities are triggered, however, Category C (3) is applicable, and the tyre storage yard will have to comply to the Norms and Standards for the storage of waste published under November 2013 under the National Environmental Management Wate Act, Act 59 of 2008. |
| Haul roads | 9 ha | | Activity 12 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 100 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*<br>Activity 19 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.*<br>Activity 24 of Listing Notice 1 (GNR 983 of GG 40772 of 7 April 2017):<br>*The development of a road—*<br>*(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.*<br>Activity 14 of Listing Notice 3 (GNR 985 of GG 40772 of 7 April 2017):<br>*The development of—*<br>*(ii) infrastructure or structures with a physical footprint of 10 square metres or more;*<br>*where such development occurs—*<br>*(a) within a watercourse;*<br>*(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.* |

## 4.3.1 Description of existing authorised mining activities

### 4.3.1.1 Life of Mine Planning

The nature of Sishen's mining operation requires regular evaluation of its mining activities in relation to the market requirements as well as new and emerging technologies. The process governing the development of the mine is called the LOM planning process, which can take up to two years to complete. This means that at any given time more than one product strategy and/or waste stripping strategy can be in the process of being investigated. The LOM planning process results in a final strategic decision regarding the life of the operation. This leads to the development of a life-of-operation schedule showing in detail all infrastructure developments and a specific product strategy. The LOM planning process at SIOM entails 7 stages as illustrated in Figure 8 below.

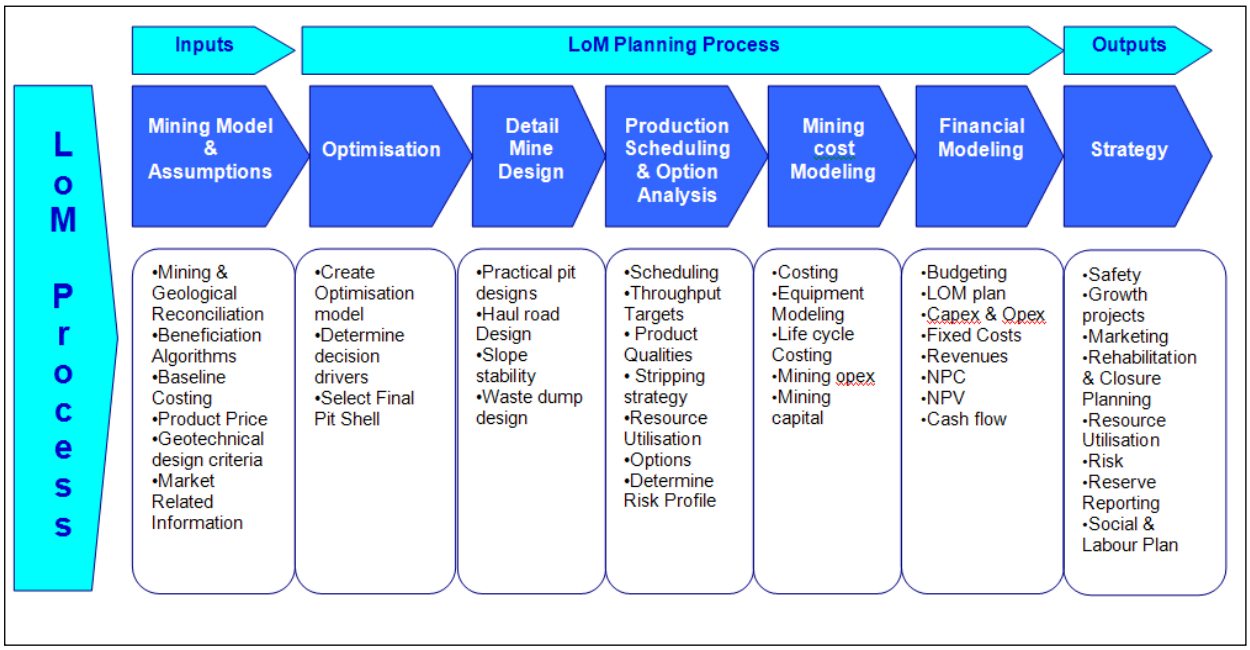


*Figure 8: Life-of-Mine Planning Process*

The life-of-mine planning process results in a final strategic decision regarding the life of the operation. This leads to the development of a life-of-operation schedule showing in detail all infrastructure developments and a specific product strategy.

**Geological Description**

The Superior-type banded iron-formations (BIFs) of the Transvaal Supergroup lithologies were deposited in two related basins, one in an extensive continental shelf environment and the other in an intra-continental sea, both situated on the Kaapvaal craton.

The basin, preserved along the western margin of the Kaapvaal craton, is referred to as the Griqualand west basin and hosts the largest known resources of high-grade hematite ore on the Southern African part of the continent. In the Postmasburg-Sishen sub-region, iron ore and associated lithologies of the Transvaal (locally termed Griqualand West Sequence) and Olifantshoek Supergroups crop out

intermittently along a 60 km arcuate belt. The iron ore outcrops define an important regional anticlinal structure known as the Maremane Dome.

At SIOM, high-grade hematite ore is extracted from the Transvaal and Olifantshoek Supergroups. The SIOM is located at the northern end of the Maremane anticline, with the Beeshoek Mine and the new Kolomela Mine, at the southern end. At this locality, the bulk of the hematite ore is buried beneath younger cover lithologies. The buried lithology's strike north south and plunge off the anticline in a northerly direction.

**Mineral mined**

The mineral mined is Iron Ore (Commodity Codes: Fe; Mineral Type: B).

**Mining Horizons**

The ores at SIOM are composed of hematite and specular hematite with minor to trace amounts of hydrated iron oxide (limonite). Four distinct ore types can be classified in the Table 4 below.

*Table 4: Typical In-Situ Grades per Ore Type*

| ORE TYPE | % | Fe | $SiO_2$ | $Al_2O_3$ | $K_2O$ | P |
|---|---|---|---|---|---|---|
| Conglomeratic and grit | 18 | 62.16 | 5.34 | 2.87 | 0.279 | 0.055 |
| Breccia | 8 | 63.39 | 3.91 | 1.98 | 0.388 | 0.078 |
| Massive | 20 | 65.16 | 2.99 | 1.35 | 0.136 | 0.044 |
| Laminated | 54 | 66.27 | 2.39 | 0.834 | 0.074 | 0.056 |

Each has unique chemical, physical and metallurgical properties. The genesis of each ore type has been influenced by regional tectonism and the preservation of each ore body is primarily determined by local geological structures.

The relative proportion of ore types also have a significant operational and financial impact. The large proportion of lower-grade breccia ore and some of the conglomerate ores at Sishen requires considerable blending to optimize utilisation of the resource.

*Quartzite*

The clastic sequence of the Gamagara Subgroup contains a prominent light-cream to dark-purple coloured quartzite, termed the Marthaspoort Formation. The quartzite unit can be up to 40 m thick. The colour of the quartzite varies in conjunction with iron impurities within the matrix of the well- rounded silica grains. The light-cream coloured quartzite has a quartz-rich matrix, is fine-grained and has a massive texture. It is this light-cream coloured quartzite that is sought for crushing material.

In the process of mining iron ore waste needs to be stripped. Some of the waste stripped is quartzite and is stockpiled for a BEE contractor. The contractor produces different products, aggregates, and ballast from the quartzite. The production rate of these products varies according to contracts to supply these products to different clients. SIOM, Kolomela mine and Transnet are the main clients for ballast and aggregate.

**Size of deposit**

The hematite ore bodies of SIOM outcrop near and along the eastern boundary of the farm Sishen and extend westwards down dip to a depth of 600 m and more. The regional dip is about 11º to the west. Local variations in the direction and magnitude, due to folding, refolding, and faulting (thrusting in some areas) are common. Consequently, domes and depressions including anticlines and synclines are present locally (Mining Works Programme, 2016).

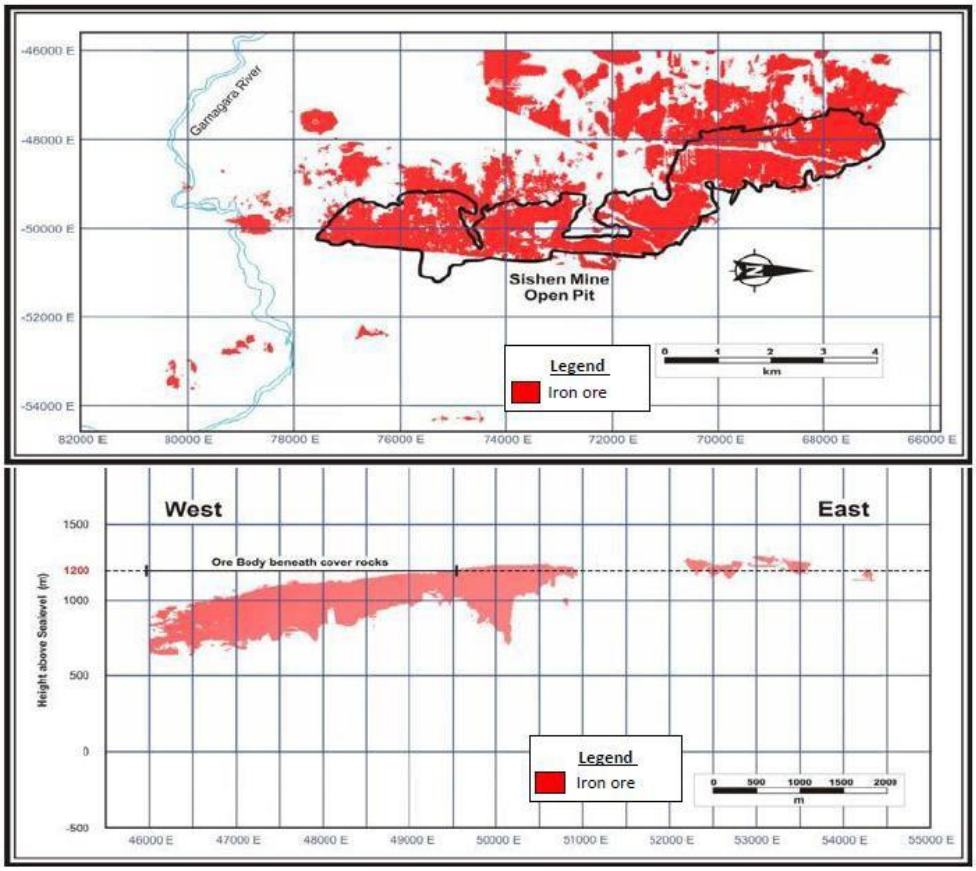


*Figure 9: Plan Extent of current Known Hematite Mineralization*

### 4.3.1.2 Mining methods

Mining is conventional truck and shovel opencast operations and involves topsoil stripping and stockpiling, blast hole drilling, blasting, dozing and excavation, shovelling and loading of material, haulage of run of mine (“ROM”) ore from the mine pit to the crushing plants, and haulage of waste material to the mining waste deposits or back into mined out areas of the mine as part of backfilling of the mine pit. Equipment used in and around the mine pit includes drill rigs, shovels, bulldozers, road graders, front-end loaders, large haul trucks and various ancillary equipment, including water tankers, road sweepers and vehicles used for application of chemical dust suppressants to haul roads.

Mining started in outcrop and shallow ore areas along the north to south strike of the ore body and is generally progressing in a westerly direction along the dip of the ore body, with the mine pit becoming increasingly deeper towards the west.

The haematite ore occurs in beds of varying thickness and grades and interbedded impurities occur in bands in the laminated ores. Blending of ore is necessitated by this complex geology and the fact that the DMS plant does not have the capability to blend different ore grades. Ongoing in-pit blending is needed to ensure that the correct product specifications are continuously achieved.

The haematite ore has a high specific gravity and is very hard and mining is therefore considered 'heavy'. Only a small proportion of the waste rock (overburden) can be free dug and most of the rock (> 75%) requires drilling and blasting. Four types of hard iron ore, namely massive, laminated, conglomerated, and brecciate iron ore are mined. Blast hole drilling is a continuous process and blasting is done once a day, typically in the early afternoons between 12h00 and 14h00, at each of the active mining areas within the mine pit.

Blasting work near buildings and surface infrastructure occurs in terms of formal permissions obtained from the Principal Inspector of Mines, Mine Health and Safety and in accordance with conditions agreed to by SIOM and the relevant stakeholders and affected parties.

The clastic sequence of the Gamagara Subgroup contains a prominent light-cream to dark-purple coloured quartzite, termed the Marthaspoort Formation. The quartzite unit can be up to 40 m thick. The colour of the quartzite varies in conjunction with iron impurities within the matrix of the well- rounded silica grains. The light-cream coloured quartzite has a quartz-rich matrix, is fine-grained and has a massive texture. It is this light-cream coloured quartzite that is sought for crushing material.

Quartzite is crushed in various sizes for e.g., railway foundation ballast or crushed stone for mixing into building cement to produce various strength concrete bases.

#### 4.3.1.3 Production rates

A high-level map indicating the basic mine design and schematic mining schedule is shown in Table 5 below provides more detail on the schematic schedule for the different mining periods and associated tonnes.

*Table 5: Estimated tonnes per period as per proposed mining schedule*

| Planned Period | RoM Ore (Mt) | Waste (Mt) |
|---|---|---|
| 2023 | 46 | 160 |
| 2024 | 46 | 179 |
| 2025 | 48 | 193 |
| 2026 | 47 | 193 |
| 2027 | 47 | 193 |
| 2028 | 45 | 194 |
| 2029 | 43 | 198 |
| 2030 | 42 | 198 |
| 2031 | 45 | 187 |
| 2032 | 44 | 144 |
| 2033 | 44 | 91 |
| 2034 | 48 | 87 |
| 2035 | 43 | 63 |
| 2036 | 38 | 53 |
| 2037 | 26 | 33 |

| Planned Period | RoM Ore (Mt) | Waste (Mt) |
|---|---|---|
| 2038 | 7 | 10 |
| 2039 | 0 | 0 |
| 2040 | 0 | 0 |
| 2041 | 0 | 0 |
| **Total** | **658** | **2173** |

#### 4.3.1.4 Planned Life of Mine

The remaining life of mine is currently estimated to be at least until 2038. The life of mine is a function of the defined mineral reserve and production rates, world iron ore market, and advancements in technologies to process lower grade ore, which could extend the life of mine. SIOM is thus projected to be a long life mine.

# 5 Policy and legislative context

Table 6 is a summary of the policy and legislative context applicable to the proposed Sishen Expansion Project.

*Table 6: Policy and legislative context*

| Applicable Legislation and Guidelines used to compile the Report | Reference where applied | Compliance and response of the Sishen Expansion Project |
|---|---|---|
| The Constitution of the Republic of South Africa, 1996. | Throughout this draft EIAR/EMPr. | The Constitution of the Republic of South Africa was considered and applied to throughout the draft EIAR/EMPr as the Constitution states that everyone has the right: (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations. |
| The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002, as amended). | | The draft EIAR/EMPr was compiled to comply to the requirements of the Mineral and Petroleum Resources Development Regulations (GN R527 dated 2004). |
| The National Environmental Management Act (Act No. 107 of 1998 as amended). | | The draft EIAR/EMPr was compiled in terms of GN R982, as amended and promulgated in terms of sections 24(5), 24M and 44 of the National Environmental Management Act, Act No. 107 of 1998 (“NEMA”). |
| The Environmental Impact Assessment Regulations (GN R982 dated 2014, as amended). | | The draft EIAR/EMPr was compiled in terms of the requirements of Appendix 2 of the Environmental Impact Assessment (“EIA”) Regulations (GN R.982 dated 2014, as amended). |
| The Environmental Impact Assessment Regulation. Listing Notice 1. (GN R983 dated 2014, as amended). | Section 4.2 of this draft EIAR/EMPr. | Activity 12, 14, 19 and 24 of Listing Notice 1 are applied for as part of the Sishen Expansion Project. |
| The Environmental Impact Assessment Regulation. Listing Notice 2. (GN R984 dated 2014, as amended). | | Activity 6 and 15 of Listing Notice 2 are applied for as part of the Sishen Expansion Project. |
| The Environmental Impact Assessment Regulation. Listing Notice 3. (GN R985 dated 2014, as amended). | | Activity 12 and 14 of Listing Notice 3 are applied for as part of the Sishen Expansion Project. |
| Integrated Environmental Management Guideline: Guideline on Need and Desirability (2017). | Section 6.1 of this draft EIAR/EMPr. | The need and desirability were assessed for the Sishen Expansion Project. |
| Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. | Chapters E, F and L of section 6.5.1; of this draft EIAR/EMPr. | Biodiversity related to the Sishen Expansion Project was considered when sites were selected, and alternatives considered. |
| The National Water Act (Act No. 36 of 1998, as amended). | Chapter G and H of section 6.5.1 of this draft EIAR/EMPr. | The Sishen Expansion Project will require a water use licence (“WUL”) for the following:<br>• Section 21 (c) and (i) for the Alternative 1 Tyre expansion area is within 500 m of four pans (WT1, WT2, WT3, WT4), Moolmans PCD within 500 m of two pans (MW3, MW4), Moolmans haul road within 500 m of pan |

| Applicable Legislation and Guidelines used to compile the Report | Reference where applied | Compliance and response of the Sishen Expansion Project |
|---|---|---|
| | | (MW5), Lyleveld pit expansion is within 500 m of the Gamagara floodline (outside of the 1:100 floodline).<br>• Section 21(g) for the Moolmans pollution control dam, Backfill of opencast pit with waste rock (Lyleveld), C & G product stockpile at Lyleveld.<br><br>The WUL will be applied for separately. |
| Regulations on use of water for mining and related activities aimed at the protection of water resources published in terms of the National Water Act under Government Notice 704 of 4 June 1999 (GN R704). | Chapter G of section 6.5.1 of this draft EIAR/EMPr. | Storm water management measures, in compliance to GN R704, will be implemented at the Sishen Expansion Project. |
| The National Environmental Management: Biodiversity (Act 10 of 2004, as amended). | Chapter E, F and L of section 6.5.1 of this draft EIAR/EMPr. | Biodiversity related to the Sishen Expansion Project and the alternatives considered. DENC permits in terms of National Environmental Management: Biodiversity (Act 10 of 2004, as amended) will be required for the Sishen Expansion Project for the removal of nationally protected trees (*Vachellia erioloba* and *Boscia albitrunca*). |
| Alien and Invasive Species Regulations (GN R598 dated 2014). | | The occurrence of alien and invasive species will be assessed and mitigated (in accordance with these regulations) during the operational phase of the Sishen Expansion Project. |
| Conservation of Agricultural Resources (Act 43 of 1983). | | Erosion potential will be assessed and mitigated (in accordance with this act) during the operational phase of the Sishen Expansion Project. |
| The National Environmental Management: Air Quality (Act 39 of 2004, as amended). | Chapter I of section 6.5.1 of this draft EIAR/EMPr. | No Atmospheric Emissions Licence is required for the Sishen Expansion Project. |
| SABS Code of Practice 0103 of 2008: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.<br>SABS Code of Practice 0328 of 2008: Environmental Noise Impact Assessments. | Chapter J of section 6.5.1 of this draft EIAR/EMPr. | The SABS Code of Practice 0103 will be taken into account when the mitigation measures for the Sishen Expansion Project. |
| National Heritage Resources Act (Act No. 25 of 1999, as amended). | Chapter K of section 6.5.1 of this draft EIAR/EMPr. | No archaeological or historical sites are directly affected by the Sishen Expansion Project. No infrastructure is located close to the identified lithics (Early Stone Age, Middle Stone Age and Later Stone Age) located in the quarry. |
| DMRE Guideline for Consultation with communities and Interested and Affected Parties. As required in terms of sections 16(4)(b) or 27(5)(b) of the MPRDA, and in accordance with the standard directive for the compilation thereof as published on the official | Section 6.3 of this draft EIAR/EMPr. | The public participation process is done in accordance with the DMRE guideline for consultation with communities and interested and affected parties. |

| Applicable Legislation and Guidelines used to compile the Report | Reference where applied | Compliance and response of the Sishen Expansion Project |
|---|---|---|
| website of the Department of Mineral Resources. | | |
| Integrated Environmental Management Information Series. Criteria for determining alternatives in EIA. | Section 6.2 and section 6.8 of this draft EIAR/EMPr. | Alternatives were assessed for the Sishen Expansion Project in section 6.2 of this draft EIAR/EMPr . |

# 6 Need and desirability of the proposed activities

## 6.1 Need and desirability in terms of the guideline on need and desirability, 2017

In 2017, the then Department of Environmental Affairs published an Integrated Environmental Management Guideline, the Guideline on Need and Desirability. The following provides information on how the guideline requirements were considered in this EIAR/EMPr.

### 6.1.1 How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?[1]

- The ecological integrity of the area was assessed as part of the specialist assessments (animal, aquatic, terrestrial biodiversity assessments and terrestrial plant species compliance statement) with the baseline environmental description provided in Section 6.5.1 below. Impacts that have been identified resulting from Sishen Expansion Project have been discussed in Section 6.6.1 of this document.
- Alternatives have been identified to limit the impact to natural resources. Refer to section 6.2. for the alternatives identified and section 6.8 for the advantages and disadvantages of the alternatives identified.
- The impacts on non-renewable resources that have been identified resulting from Sishen Expansion Project have been discussed in Section 6.6.1 of this document. Further thereto, a separate WUL application will be submitted for the Sishen Expansion Project.
- The *Sishen Expansion Project - Storm Water Management Plan* compiled by Shangoni Management Services (Pty) Ltd dated 31 May 2023 proposed measures that will ensure clean and dirty water separation to meet the requirements in accordance with the best practice guidelines (DWAF, 2006), Section 19 of the National Water Act and Regulation GN 704 (No. 704 of 4 June 1999) in terms of the National Water Act (Act No. 36 of 1998).
- There are no infrastructure situated in close proximity to the identified lithics (Early Stone Age, Middle Stone Age and Later Stone Age) located in the quarry.

[1] Section 24 of the Constitution and section 2(4)(a)(vi) of NEMA refer.

- The preferred alternatives in Section 6.2 (Moolmans pollution control dam alternative 1 is situated to the north of Moolmans workshop area, , the proposed haul road at Moolmans alternative 1 is located west of pan (MW5), Tyre expansion area alternative 1 expansion to the south west of the current tyre storage area; and Lylyveld C & G stockpiles and backfilled area alternative 1 is situated within the existing pit from west to east; the entire Lylyveld pit will be backfilled and the C&G stockpile placed on the backfilled area within the pit.
- Sishen Expansion Project will allow continuation of mining activities. Sishen Expansion Project, therefore, ensures that those who are already employed remain employed.
- Knowledge gaps as well as relevant assumptions were identified in section 13 of Part A of this EIAR/EMPr.
- All negative and positive impacts associated with Sishen Expansion Project have been identified by the specialists and discussed in Section 6.8 below.

### 6.1.2 Promoting justifiable economic and social development[2]

- The proposed SWEP will allow continuation of mining activities and ensure security of the Life of Mine (to the year 2039) of SIOM.
- The local economy is largely dependent on the mining sector. The proposed Sishen Expansion Project will continue to contribute to the socio economy in the area as mining of iron ore can continue.
- A Social and Labour Plan 2022 ("SLP") has been developed and implemented for SIOM.
- The needs of the community will be determined through the public participation process of this EIAR/EMPr with the results of the public participation process presented in the Public Participation Report. The public participation process that has been conducted aims to ensure that all I&APs are provided with an opportunity of access to information regarding the Sishen Expansion Project+

## 6.2 Details of alternatives considered as part of the proposed project

The following alternatives have been identified as part of the Sishen Expansion Project and will be further be assessed in the EIAR/EMPr.

### 6.2.1 Location alternatives

#### 6.2.1.1 Moolmans pollution control dam 120 x 120 m

- Alternative 1 (preferred alternative) pollution control dam is situated to the north of Moolmans workshop area.; and
- Alternative 2 pollution control dam is situated to the northwest of the Moolmans workshop area. Refer to

[2] Section 24 of the Constitution refers.

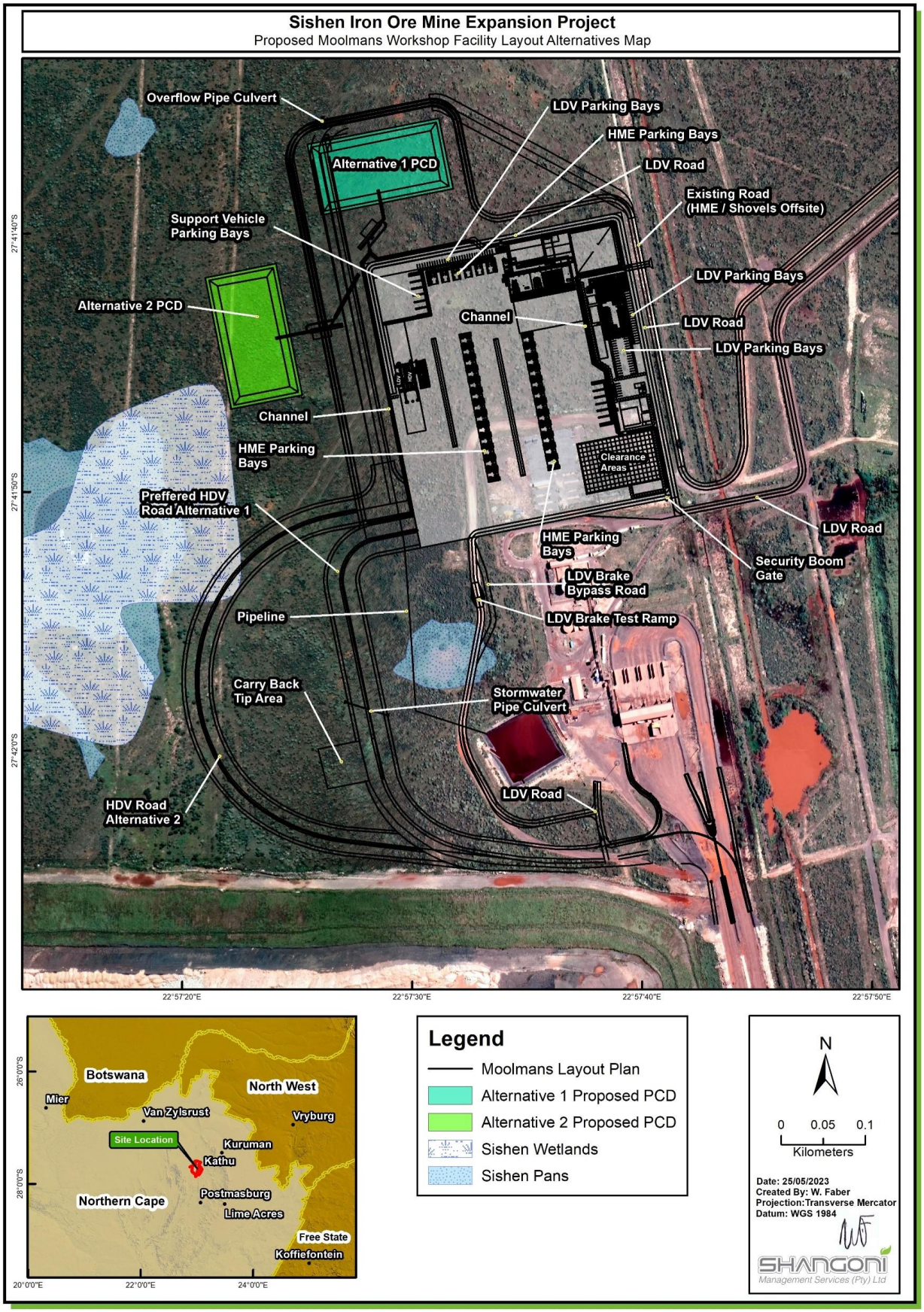
Sishen Iron Ore Mine Expansion Project
Proposed Moolmans Workshop Facility Layout Alternatives Map
Overflow Pipe Culvert
Alternative 1 PCD
LDV Parking Bays
HME Parking Bays
LDV Road
Existing Road (HME / Shovels Offsite)
Support Vehicle Parking Bays
Alternative 2 PCD
Channel
LDV Parking Bays
LDV Road
LDV Parking Bays
Channel
HME Parking Bays
Clearance Areas
Preffered HDV Road Alternative 1
HME Parking Bays
LDV Brake Bypass Road
LDV Brake Test Ramp
LDV Road
Security Boom Gate
Pipeline
Carry Back Tip Area
Stormwater Pipe Culvert
LDV Road
HDV Road Alternative 2
27°41'40"S
27°41'50"S
27°42'0"S
22°57'20"E
22°57'30"E
22°57'40"E
22°57'50"E
Botswana
North West
Mier
Van Zylsrust
Vryburg
Site Location
Kuruman
Kathu
Northern Cape
Postmasburg
Lime Acres
Free State
Koffiefontein
26°0'0"S
28°0'0"S
20°0'0"E
22°0'0"E
24°0'0"E
Legend
Moolmans Layout Plan
Alternative 1 Proposed PCD
Alternative 2 Proposed PCD
Sishen Wetlands
Sishen Pans
N
0 0.05 0.1
Kilometers
Date: 25/05/2023
Created By: W. Faber
Projection:Transverse Mercator
Datum: WGS 1984
SHANGONI
Management Services (Pty) Ltd

Figure 10.

#### 6.2.1.2 Moolmans haul road

- Alternative 1 (preferred alternative) rerouting the proposed haul road to avoid the pan (MW4);

- Alternative 2 proposed new haul road between pans (MW 4 and 5).

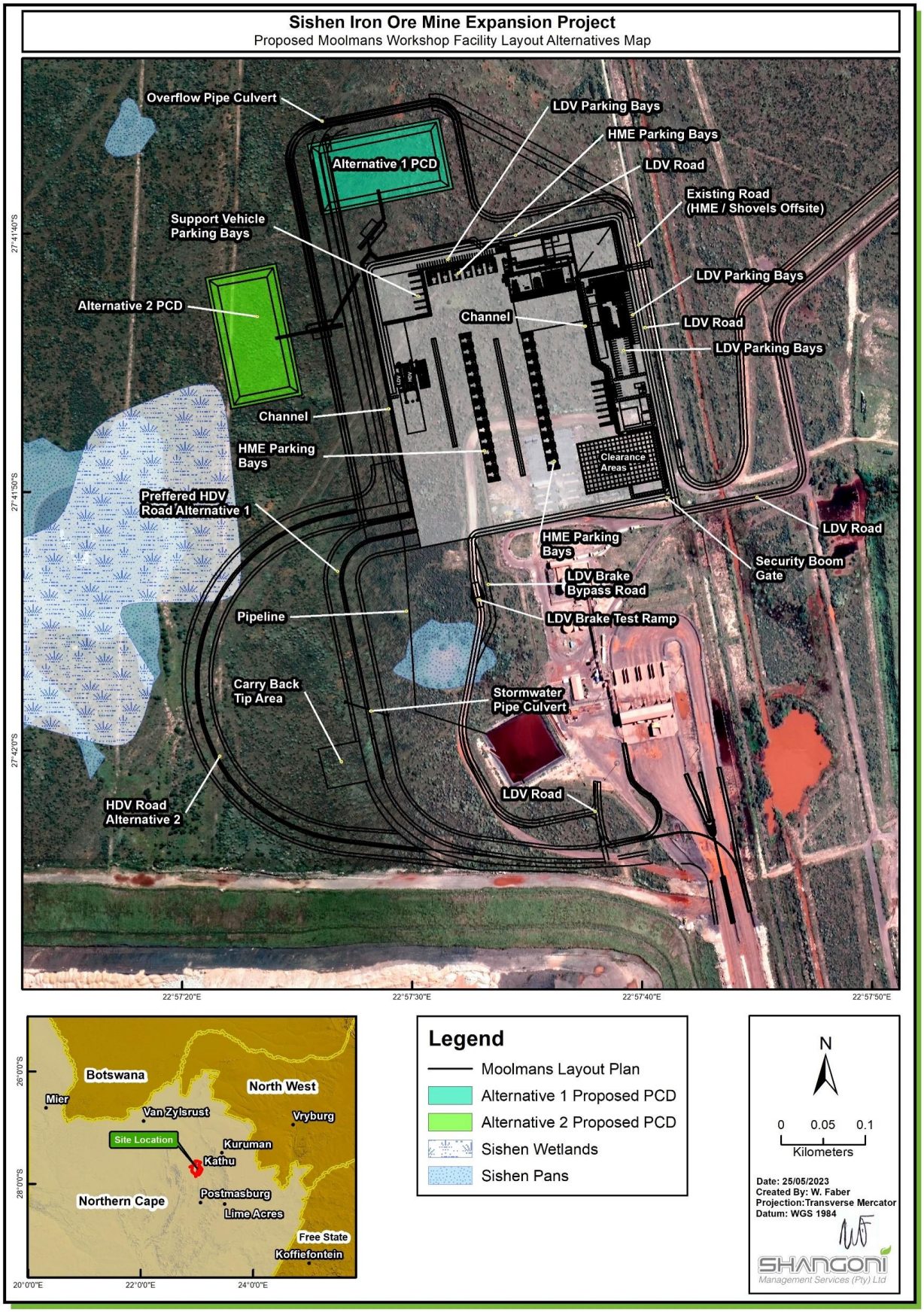


Figure 10.

#### 6.2.1.3 Lylyveld C & G stockpiles and backfilled area

- Alternative 1 (preferred alternative) is situated within the existing pit from west to east; the entire Lylyveld pit will be backfilled and the C&G stockpile placed on the backfilled area within the pit; and
- Alternative 2 is situated within and outside the existing pit from north to south. The pit will only be partially backfilled and a new greenfield area will be disturbed for the C&G stockpile. Refer to Figure 11.

#### 6.2.1.4 Tyre expansion area

- Alternative 1 (preferred alternative) expansion to the southwest of the current tyre storage area to avoid sensitive Camel thorn trees. However, alternative 1 is situated closer to the pans but less of a fire hazard as it is further from the home steads; and
- Alternative 2 expansion to the northeast of the current tyre storage area is situated closer to the homesteads but further from the pans. Refer to Figure 12.

#### 6.2.1.5 No-go option

The no-go option would mean that the *status quo* of the environment would stay as is and there would be no additional impacts to the site. However, if the pit is not expanded inclusive of the pushbacks (PB 19) and expansion of the Lylyveld pit the mine will not be economical feasible.

Currently, the Aveng Moolmans workshop is situated at the northern section of the mine. The workshop was constructed on a waste dump in 2009. Geotechnical investigations showed that the workshop will settle with the waste dump as the dump was not compacted, however, internal studies have recently been conducted and have shown that the settlement of the waste dump was more than had been anticipated during the design of the workshops. Therefore, the workshop will have to be relocated. If this is not done there is a safety risk. It is proposed to move the workshop to north of Nooitgedacht.

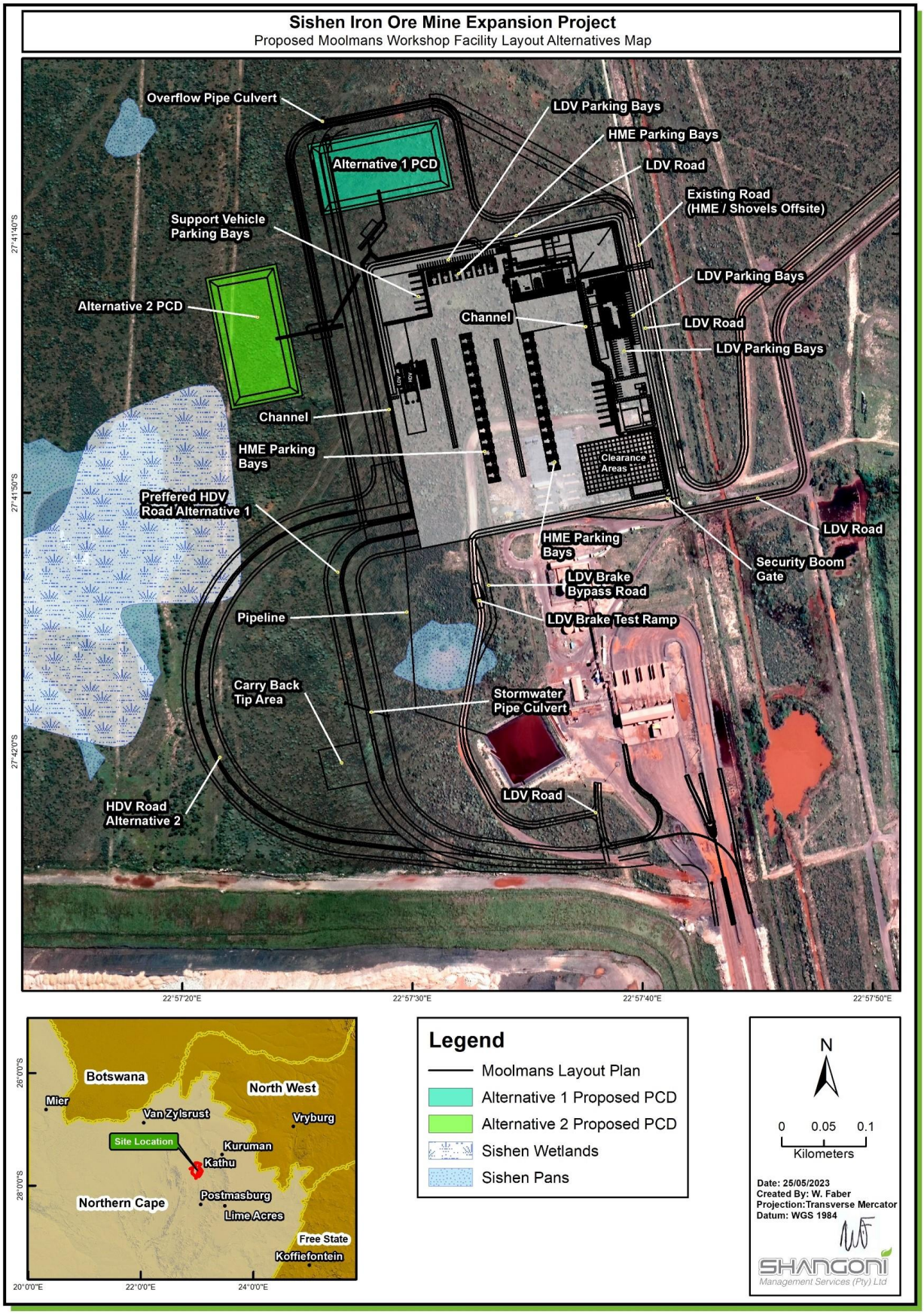


Figure 10: Moolmans workshop pollution control dam and haul road alternatives

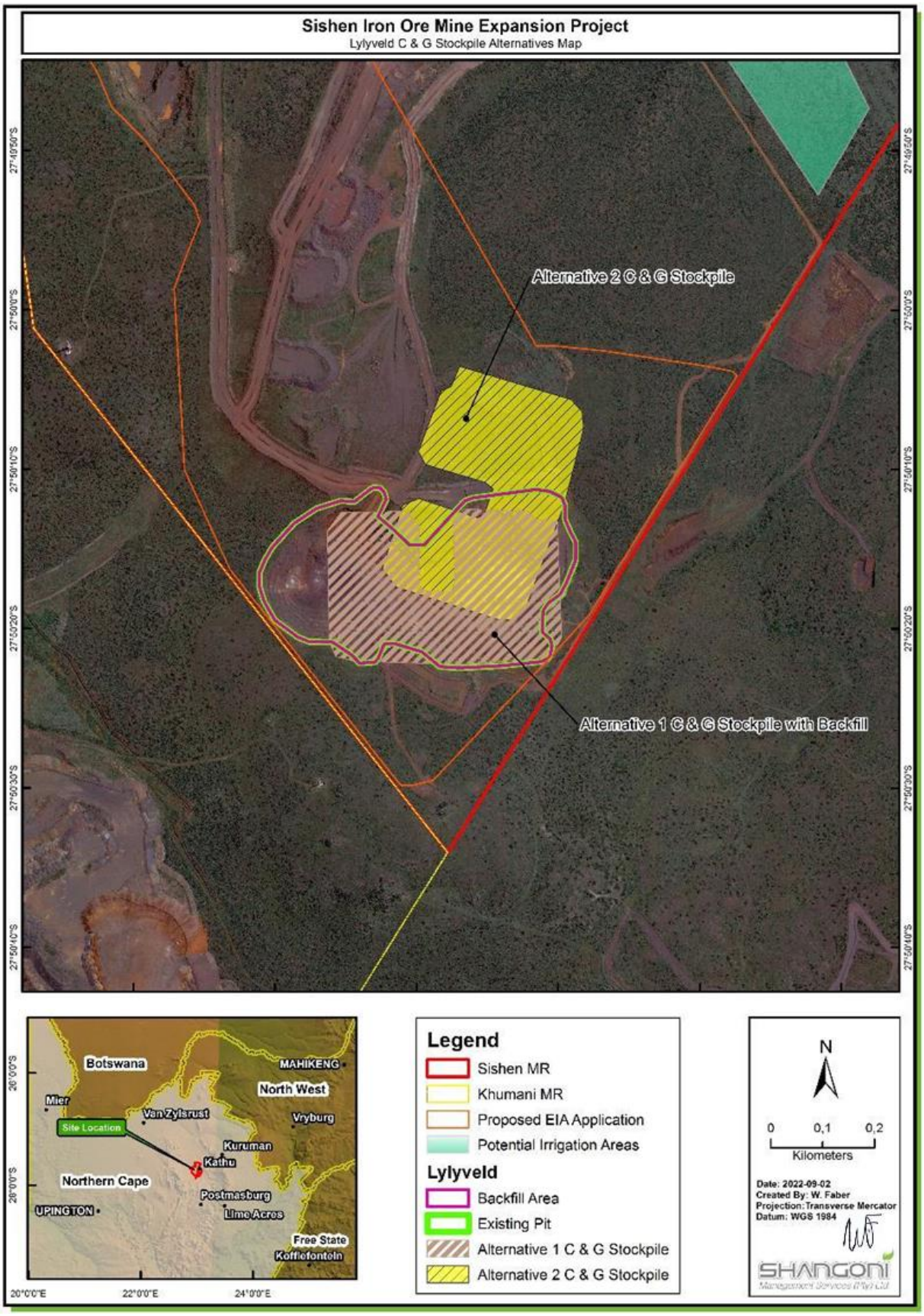


*Figure 11: C&G stockpile area alternatives*

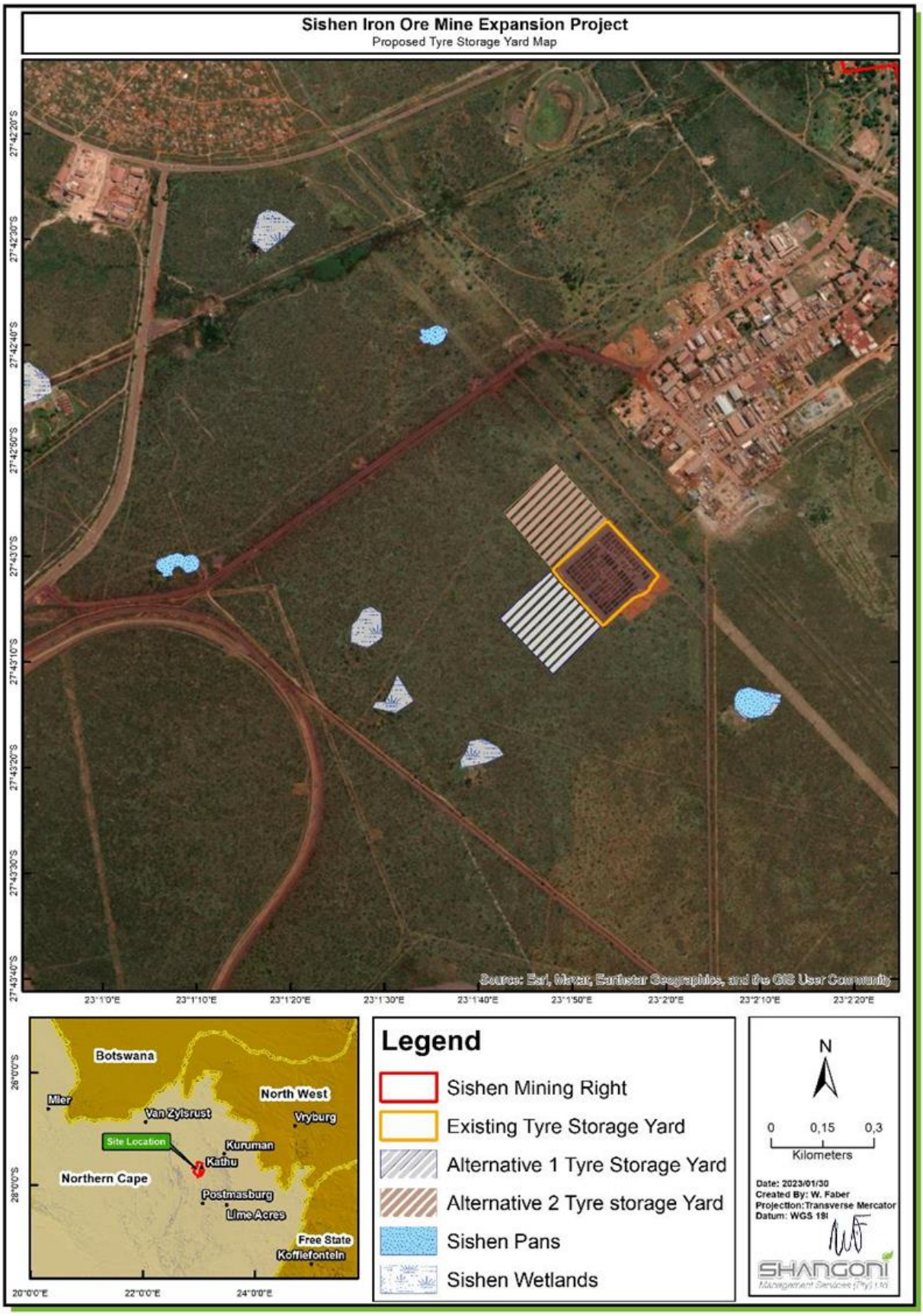


*Figure 12: Tyre expansion area alternatives*

## 6.3 Details of the Public Participation Process followed

The public participation process was conducted by Shangoni Management Services (Pty) Ltd in terms of:

- The procedures and provisions in terms of the NEMA:
- Chapter 6 of the 2014 EIA Regulations;
- GN 807 of 2012; Public Participation Guideline; and
- Other relevant legislation such as the Promotion of Access to Information Act (PAIA), 2000.

### 6.3.1 Identification and registration of I&APs and key stakeholders

The below lists the landowners, adjacent landowners and organs of state identified and notified (by means of e-mail, telephone, fax and/or post) of the SIOM. All organs of state that may have jurisdiction in respect of the proposed project is considered to be registered I&APs. The following groups of interested and affected parties were identified: For a detailed list refer to Annexure D.

- Forum farmers;
- Eskom;
- Transnet;
- Gatelopele Investments & Mining Cc;
- M & S Consulting;
- Ditukus Projects (Pty) Ltd;
- Ndi Geological Consulting Services;
- Northern Cape: Department of Water & Sanitation;
- Northern Cape: Department of Agriculture, Forestry & Fisheries;
- Northern Cape: Department of Mineral Resources;
- Vaal River Proto – Cam;
- Department Of Social Development;
- Department Of Environment and Nature Conservation;
- SAHRA;
- Northern Cape: Department of Agriculture, Forestry & Fisheries;
- Chief Director: Land Restitution Support;
- Northern Cape Department of Roads and Public Works;
- Gamagara Local Municipality Ward 1; and
- John Taolo Gaetsewe District Municipality.
- Assmang Iron Ore (Khumani Mine).
- South African National Civic Organisation (“SANCO”).
- Catchment Protection Agency (“CPA”).

### 6.3.2 Methods of notification

#### 6.3.2.1 Scoping phase

A detailed public participation process was undertaken as part of the initial application - and scoping phase for the Sishen Expansion Project. The following has been conducted as part of the Environmental Authorisation Application (proof hereof is included in the Public Participation Report attached as Annexure D to this report):

- Advertisements.
  - A Newspaper advertisement was placed in the Kathu Gazette on 14 October 2022.
- Site notices.
  - Five (5) site notices were placed at the Kathu Foodzone, Kathu Public Library, Gamagara Local Municipality, Sishen auditorium, and main gate.
- Written notices.
  - Written notices (including Background Information Documents) were distributed to Interested and Affected Parties ("I&APs").
- Availability of Scoping Report for public review
  - The draft Scoping Report ("DSR") was made available for public and stakeholder review for a period of 30 days (from 14 October 2022 until 14 November 2022). Hard copies of the mentioned document were made available at the Sishen Auditorium. An electronic copy of the DSR was posted on the Shangoni's website.
  - Notices providing the detail of the public viewing station and review period, were sent to registered I&APs via e-mail. This notification also formed part of the above-mentioned advertisement and site notices.

#### 6.3.1.1 EIAR/EMPr phase

**Advertisement(s)**

The proposed project will be advertised in the Kathu Gazette on the 2 June 2023. The Kathu Gazette was found to be the most appropriate newspaper in terms of its accessibility to the I&APs. Placement of site- and public notices

Notice was also given to Interested and Affected Parties ("I&APs") by notice boards. Notice boards were placed at different, noticeable, and conspicuous places on the 2 June 2023.

#### 6.3.1.2 Background Information Document

The Background Information Document ("BID") developed for the proposed project provides background information pertaining to the project and is intended to inform I&APs of the proposed project. The BID also includes a registration form that I&APs, stakeholders and organs of state are encouraged to complete in order to register as an I&AP for the proposed project. The BID was made

available on the 2 June 2023 to all landowners within and surrounding the mine as well as to all organs of state that may have jurisdiction over any aspect of the activity. The BID will also be made available to any other person who becomes involved in the on-going Public Participation Process ("PPPI&APs register

Once all landowners, adjacent landowners, organs of state and the public are notified of the proposed project, an I&APs register is kept and will be updated during the process. A copy of details may be provided upon request.

#### 6.3.1.3 Access and opportunity to comment on written submissions

The draft EIAR/EMPr was made available to the public for review for a period of thirty (30) days, from 2 June to 3 July 2023. Hard copies of the mentioned document are available at the Sishen Auditorium. A copy of the mentioned document was made available on the Shangoni's website (www. shangoni.co.za) for the I&APs to view. All the registered I&APs were notified of the availability of the EIAR/EMPr for public review by 31 May 2023.

#### 6.3.1.4 Public Meeting

A public meeting will be held at the Namakwari Lodge, in Kathu on the 14 of June 2023 at 10:00. All interested and affected parties will be invited to the public meeting but everyone is welcome to attend.

### 6.3.2 Consultation with the relevant Authorities

#### 6.2.3.1 Application form in terms of the NEMA

The application for environmental authorisation was submitted to the DMRE, via SAMRAD, and a hard copy was submitted on 21 October 2022. A copy of the application for environmental authorisation form is attached hereto in Annexure C1. A copy of DMRE's acknowledgement of receipt letter of the Scoping Report is also attached as Annexure C2.

#### 6.2.3.2 Further consultation with relevant Authorities

Further consultation will be done with the DMRE during the EIA phase.

## 6.4 Summary of issues raised by I&APs

Table 7 below shows a summary of the comments and issues raised and responses thereto.

*Table 7: Summary of the issues raised by the I&APs*

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| Dirk Coetzee (Khumani mine) | 3 November 2022 | Good day<br><br>Please register Khumani Mine as an I&AP<br>Thanks for registering me (Khumani) | Good day,<br><br>Noted, we will register you as an interested and affected party. | Annexure D |
| | 4 November 2022 | I had a look at the map but I'm not sure, will the tar road (325) between Bruce and Parson be affected with the project. | The Sishen Expansion Project will affect the old Dingleton road close to the T-junction where heavy and light vehicles will be required to cross the road to the proposed C&G stockpile area. Traffic precautionary measures will be implemented for traffic control. The road will be closed when blasting takes place at PB 21 and PB 19. | Annexure D |
| South African Heritage Resources Agency Natasha Higgitt | 7 November 2022 | Interim Comment<br><br>Dr Bruce Rubidge, Mr Siegwalt Küsel and Sidney M Miller were appointed to provide heritage specialist input as part of the EA as per section 24(4)b(iii) of NEMA and section 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) that complies with section 38(3) of the NHRA.<br><br>*Rubidge, B. 2022. Desktop Palaeontological Impact Assessment: Sishen Iron Ore Mine Expansion Project, Northern Cape Province.*<br><br>The proposed development area is underlain by rocks of the Precambrian Transvaal Supergroup, Quaternary calcrete and alluvial deposits, Wolhaarkop Formation, superficial Tertiary calcretes and aeolian deposits of the Quaternary Kalahari Formation. Fossils might be present in the Kalahari sands but are often not well preserved. A Chance Finds Procedure is recommended. | Good day,<br><br>We hereby acknowledge receipt of your correspondence and take note of the contents.<br><br>We would like to bring your attention to the fact that the chance find protocol can be found on page 10 Appendix A of the *Rubidge, B. 2022. Desktop Palaeontological Impact Assessment: Sishen Iron Ore Mine Expansion Project, Northern Cape Province.*<br><br>In terms of clarifying the existence of the cemetery an addendum report was uploaded to SAHRIS to clarify that no graves were found at the proposed HME parkup area. | Annexure D |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| | | *Küsel, S and Miller, S. M. 2022. 1st phase H.I.A. of a proposed extension and upgrading, also known as The Sishen Iron Ore Mine Expansion Project for Sishen Mine.*<br><br>A small scatter of a mixture of ESA, MSA and LSA lithics of low heritage significance was identified within the development footprint. It is noted that the lithics site has been provided with an exclusion zone. The specialist notes that the previously identified cemetery could not be found. Recommendations provided in the report and addendum include the following:<br>• It is recommended that the lithics site be granted destruction authorisation at the discretion of the<br>• relevant heritage authority outside of the formal permitting process;<br>• The source of the identification of the cemetery be revisited for clarification; and<br>• A Chance Finds Procedure be implemented.<br><br>The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit requests that the clarification of the existence of the cemetery be provided as an addendum to the HIA as part of the EIA phase of the application.<br><br>Should a cemetery be found, an assessment of the impact to the cemetery must be provided, with recommendations for the management of the site. Further comments will be issued during the EIA phase and the submission of the draft EIA inclusive of appendices.<br><br>Should you have any further queries, please contact the designated official using the case number quoted above in the case header. | | |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| South African Heritage Resources Agency<br>Natasha Higgitt | 17 March 2023 | Interim Comment<br><br>In an Interim Comment issued on the 07/11/2022, SAHRA requested that the clarification of the existence of the cemetery be provided as an addendum to the HIA as part of the EIA phase of the application. Since the issuing of the Interim Comment, an Addendum has been submitted to the case (23/02/2023).<br><br>*Küsel, S. U. 2023. HIA Addendum: Sishen Iron Ore expansion project*<br><br>The addendum details a comprehensive survey that concluded that no grave is present at the previously mentioned location. A Chance Finds Procedure is recommended.<br><br>Interim Comment<br><br>SAHRA is satisfied with the contents of the Addendum to the HIA. Further comments will be issued upon receipt of the draft EIA inclusive of appendices.<br><br>Should you have any further queries, please contact the designated official using the case number quoted above in the case header. | Good day,<br><br>Your comments are noted. A chance find procedure is included in the addendum. | Refer to annexure E7. |
| Andre Johnson (Khumani mine) | 14 November 2022 | Dear Lee Anne,<br>Just a couple of clarity questions following our telephonic discussion<br>• Can you please elaborate on the “precautionary measures” for traffic control<br>  ○ Signage (stop, speed, HME crossing, etc)<br>  ○ 4 way stop or 2 way?<br>  ○ Illumination – lights and on-road?<br>  ○ Speed control / calming – humps/bumps and signage?<br>  ○ Will slipways be built/accommodated for? | Dear Andre,<br><br>We hereby acknowledge receipt of your email and will respond in due course. | |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| | | ○ Appropriate road width<br>○ Detours / traffic control during construction phase?<br>○ Dust suppression measures? (water/broom and frequency – who will be responsible?)<br>○ Painting of road markings – who will be responsible?<br>• As mainly our LDV's and private vehicles will be affected, how do you see this to be managed<br>o Normal NRTA rules and regulations will apply?<br>• Do we need to put on our buggy whips (flags) for TMM and LDV interaction/detection<br>• How active will this crossing be?<br>○ Will traffic analyses be conducted and who will conduct it?<br>○ Total number of HME's that will make use of crossing?<br>○ Type and size of HME that will be utilizing the crossing?<br>○ Will HME's be restricted to non-peak times to be active?<br>• What happened to the road proposal connecting Bruce with Parson, apparently this was mentioned a couple of years ago as an option for Khumani vehicles to use.<br>○ Currently a gravel road if approved who will tar the road?<br>• Who will take ownership of crossing? Maintenance / construction of intersection? (during and post construction)<br>• Will HME's make use of tarpaulins for dust and stones?<br>• Entrance angle to current tar road any inclines or declines present? (possible need for additional safety measure – speed bumps and safety berms)<br>• Visibility for ingress and regress of traffic at crossing – trees / bush?<br>• Envisaged time frame to start of project and duration of project?<br>• Pedestrians crossing? | | |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| Northern Cape Department of Mineral Resources and Energy | 23 March 2023 | 1. The Department has evaluated the submitted FSR and Plan of Study for Environmental Impact Assessment received on 07th December 2022 and is satisfied that the documents comply with the minimum requirements of Appendix 2(2) of National Environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014. The SR is hereby accepted by the Department in terms of regulation 22(a) of the NEMA EIA Regulations, 2014.<br>2. You may proceed with the environmental impact assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the NEMA EIA Regulations, 2014 and all necessary specialist studies must be included.<br>3. Please ensure that surrounding communities including the farm workers are given the opportunity to participate on the public participation process and the Draft Environmental Impact Assessment Report is provided to the community representative for commenting purpose. You are also advised to put a copy of Environmental Impact Assessment Report (EIAR) where the surrounding community will be able to assess it as per Regulation 41 (6) b, as not everyone have access to internet and your office is far from the community affected.<br>4. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Environmental Impact Assessment Report (EIAR). This includes but is not limited to the Provincial Heritage Resources Authority and/or South African Heritage Resources Agency, Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS), the local municipality, Local community structures (e.g Traditional Leaders, Ward Councillor's, South African National Civic Organisation | 1. Noted.<br>2. Noted.<br>3. Noted. The issue was discussed with DMRE and it was agreed upon that the draft environmental impact assessment report is made available to the farm workers. The draft report will be published on the Shangoni Management Services (Pty) Ltd website as well as hard copies of the reports will be placed at the Kathu Library and Sishen Mine Auditorium. There will also be a public meeting hosted in June 2023 and hard copies of the reports will also be available at the venue. All the interested and affected parties will be invited to the public meeting of which farmers attend. The farm workers can also attend the meeting. This approach was accepted by DMRE.<br>4. Noted.<br>5. Noted.<br>6. Noted.<br>7. Noted.<br>8. Noted.<br>9. Noted.<br>10. Noted.<br>11. Noted.<br>12. Noted. | Refer to section 6.3.3.1 |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| | | ("SANCO"), Catchment Protection Agency ("CPA"). Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should be submitted to the Department.<br>5. In case where you will also use the proof of correspondence of the registered postage, please include the results of the postage which shows when and who collected the mail.<br>6. The applicant is hereby reminded to comply with the requirements of regulation 3 of the NEMA EIA Regulations, 2014 with regards to the time period allowed for complying with the requirements of the Regulations.<br>7. Please ensure that the EIAR includes the signed A3 size locality maps of the area and illustrates the exact location of the proposed development. The maps must be of acceptable quality and as a minimum, have the following attributes:<br>a. Maps relatable to one another;<br>b. The flood line must be delineated on the topographical map<br>c. Co-ordinates;<br>d. Legible legends;<br>e. Scale of 1 :50 000;<br>f. The map must be signed and dated too.<br>8. Further, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provisions of any Specific Environmental Management Acts (SEMAs), proof of such application will be required. You are hereby requested to submit four (4) copies manually and one (1) electronic copy through SAMRAD, of an environmental impact assessment report, inclusive of any specialist reports and an EMPr which have been subjected to the public participation process of at least 30 days incorporating the comments received, including all comments from the competent authority. Kindly refer to section 24N(2) of National Environmental | | |

| Interested and Affected Parties | Date Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant | Section and Paragraph Reference in this Report Where the Issues and or Responses Were Incorporated. |
|---|---|---|---|---|
| | | Management Act, 1998 (Act 107 of 1998) as amended and Appendix 2, 4 and 6 of the EIA Regulations for the minimum requirements set for the aforementioned reports. The public participation process should be conducted as stipulated in chapter 6 of the EIA Regulations and taking into considerations any guideline applicable for public participation.<br>9. Kindly note that acceptance of your scoping report application does not grant you a right to commence with the listed activities applied for. Acceptance simply confirms that your application will be processed further and a recommendation on granting or refusal of an environmental authorisation will be forwarded to the Minister or his delegate for consideration, and the decision will be communicated as stipulated in regulation 4(1) of the EIA Regulations.<br>10. You should also note that commencement with a listed activity without an environmental authorisation contravenes the provisions of section 24F (1) of National Environmental Management Act, 1998 (Act 107 of 1998), as amended (NEMA) and constitutes an offence in terms of section 49A (1) (a) of NEMA.<br>11. Further note that in terms of regulation 45 of the EIA Regulations; your failure to submit the documents or meet any timeframes prescribed in terms of the said Regulations will result in your application deemed to have lapsed.<br>12. Your attention is brought to Section 24F of the NEMA which stipulates "that no activity may commence prior to an environmental authorisation being granted by the competent authority". | | |

## 6.5 Description of baseline environment

### 6.5.1 The type of environment affected by the Sishen Expansion Project

A baseline description or *"status quo"* of the present environmental situation is provided in this part of the document. The following attributes / aspects have been described in detail, in the following respective chapters:

- Chapter A: Geology.
- Chapter B: Climate.
- Chapter C: Topography.
- Chapter D: Soils, Land Use and Land Capability.
- Chapter E: Vegetation.
- Chapter F: Fauna.
- Chapter G: Surface water.
- Chapter H: Groundwater.
- Chapter I: Air Quality.
- Chapter J: Noise.
- Chapter K: Archaeology and cultural history.
- Chapter L: Sensitive landscapes.
- Chapter M: Visual aspects.
- Chapter N: Regional socio-economic structure.

#### Chapter A: Geology

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron ore Mine: Geohydrological Study and Impact Assessment for the Sishen Expansion Project – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2022.

**Regional Geology**

Most of the surface area underlying the application areas is mainly covered with superficial sediments of the Kalahari Group (Tl), predominantly thick calcrete ("surface limestone") hardpans, aeolian sands, clays and surface gravels. The surface geology of the proposed Pushback 21 pit is on thick sequences of younger clastic sediments including shales, quartzites, sandstone and conglomerates of the Gamagara Formation. Conformably underlying the Gamagara Formation is the Kuruman Iron Formation (banded iron formation) of the Asbestos Hills Subgroup, which can be up to 500 m thick. Locally the upper portion of the banded iron formation has been enriched to ore grade (Fe >60%), and the ores found within this unit comprise the bulk of the high-grade iron ores in the region.

The oldest rocks in the region are the ~1.6 km thick carbonate platform sediments (dolomites with minor limestone, chert and shale) of the Campbell Rand Subgroup of the Ghaap Group. Outcrops of this unit are located southeast of the open pit Diabase or dolerite dykes are common, which has an important influence on the groundwater occurrences in the area. They form impervious barriers and

compartmentalise the groundwater. The most prominent dyke is the Kathu dyke striking northwest through the Kathu town. Major municipal and industrial abstraction from groundwater/ boreholes is along this dyke (Beukes, 1983).

**Local Geology**

The banded iron ore formation ("BIF") of the Asbestos Hills Subgroup are characteristically fractured and brecciated, especially near the contact with the Wolhaarkop Breccia. Both upper and lower contacts are erosion surfaces and together with the lack of easily identifiable marker horizons, make correlation of individual beds virtually impossible. A highly altered, intrusive sill is commonly found separating the BIF from the overlying laminated ore. At SIOM it is generally less than 2 m thick. The sill is invariably folded into the basinal geometry and only rarely crosscuts (intrudes) the ore bodies. Numerous intrusive dykes occur but seldom outcrop as the dykes are overlain by the Kalahari Formation and only visible on surface where the soil or sediment cover are very thin and eroded away. Refer to Figure 13.

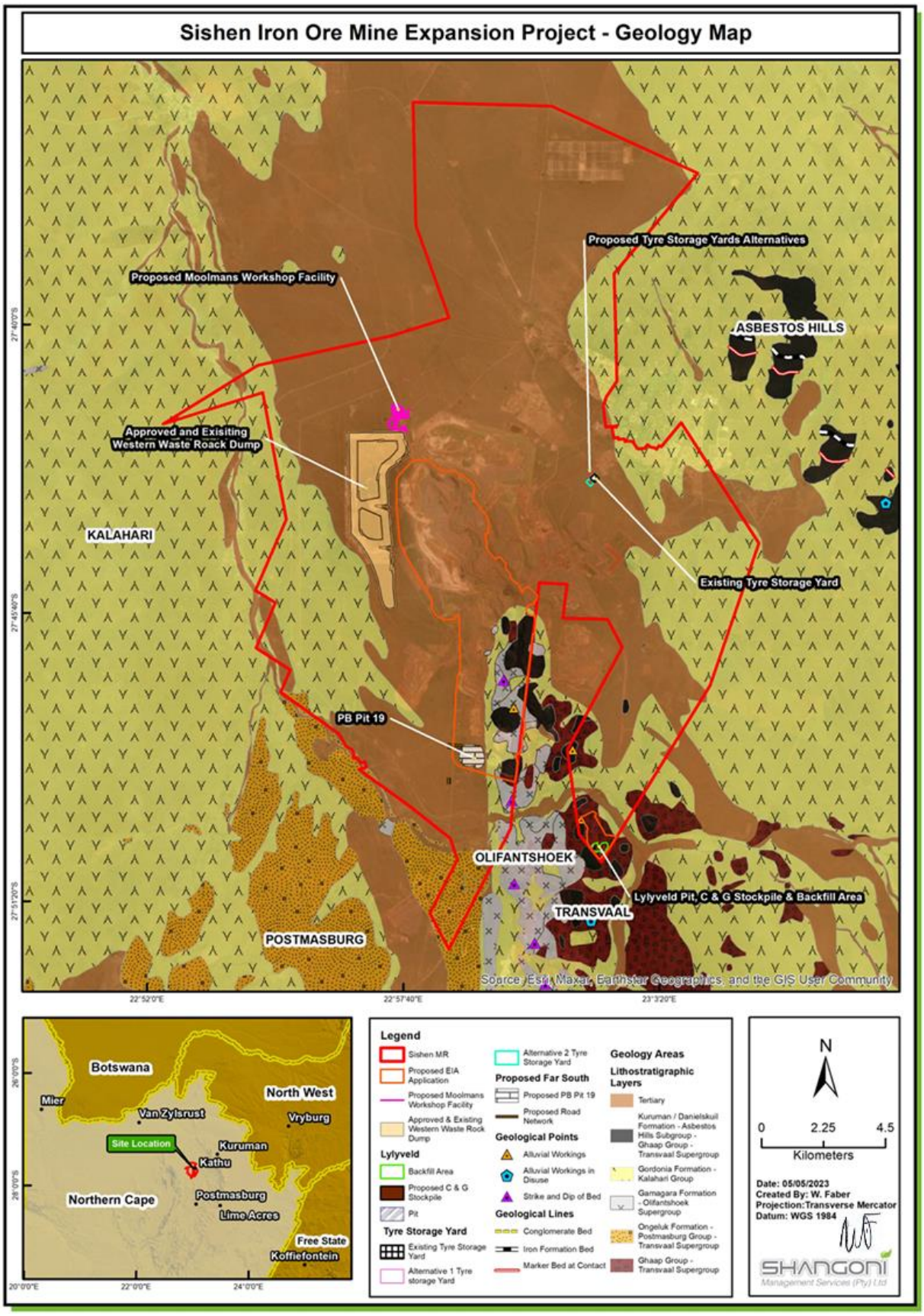


*Figure 13: Geology associated with the proposed Sishen Expansion Project*

### Chapter B: Climate

The following information was sourced from the *Terrestrial Biodiversity Impact Assessment for Sishen Expansion Mine Application,* compiled by Enviro-EAP dated September 2022 refer to Annexure E3.

Kathu experiences summer rainfall with most rain falling from November to April. Rainfall is highly unpredictable and averages around 418 mm per annum with a range of 156 to 1088 mm depending on the cycle. This rain usually falls as a result of thunderstorms when tropical thunderstorm activity extends southwards over the Kalahari. Summer temperatures can reach 40 ºC (average 16 – 30 ºC) whereas the dry winters are mild to cold. Winter daytime temperatures can reach 25 ºC but at night frost can occur and temperatures can average below 0 ºC (Van Rooyen, 2006).

### Chapter C: Topography

The following information was sourced from the *Terrestrial Biodiversity Impact Assessment for Sishen Expansion Mine Application,* compiled by Enviro-EAP dated September 2022 refer to Annexure E3.

The study area is located at 1235 metres above mean sea level (“mamsl”) and is relatively flat. Elevation does not vary much over the whole site and there is almost no relief which is characteristic of the wide plain where Kathu is found. Aspect, therefore, does not have an influence on the vegetation. Refer to Figure 14.

### Chapter D: Soils, land use and land capability

The following information was sourced from the *SIOM SWEP Ecological Assessment Report, compiled by EndemicVision Environmental Services,* dated 4 December 2020.

The soils in an area are closely related to the topography and underlying geology of the area. The site has a relatively flat topography with only underlying calcretes and no outcrops.

Soils on-site are primarily red aeolian sand with surface calcretes. This is the norm for the largest part of the Kalahari region. Deeper sand soils are expected to occur to the south of the proposed layout where an increase in *Vachellia erioloba* trees are seen. *Vachellia erioloba* and *Vachellia haematoxylon* serve as indicators of Hutton soils deeper than 1m, whilst dense stands of *Senegalia mellifera* tend to dominate the same soils on slightly higher elevations (Mucina & Rutherford, 2011).

The soil type (ZA900) is Ferralic arenosols (ARo), the South African equivalent is the Hutton soil form. Ferralic arenosols are deep reddish-brown to bright brown sandy soils that occur on flat to undulating topographies. These soils tend to have absent or weak horizon development and have aeolian sand as the parent material. Refer to Figure 15.

Agricultural land capability in the area is low and generally suitable for light grazing, with small pockets of land on steeper slopes that are not suitable for agriculture but for conservation only. The area is generally not conducive to cultivation due to the low rainfall, semi-arid climate and shallow soil depths. Surface calcretes are common and ≥ 10 m thick. Refer to Figure 16 and Figure 17.

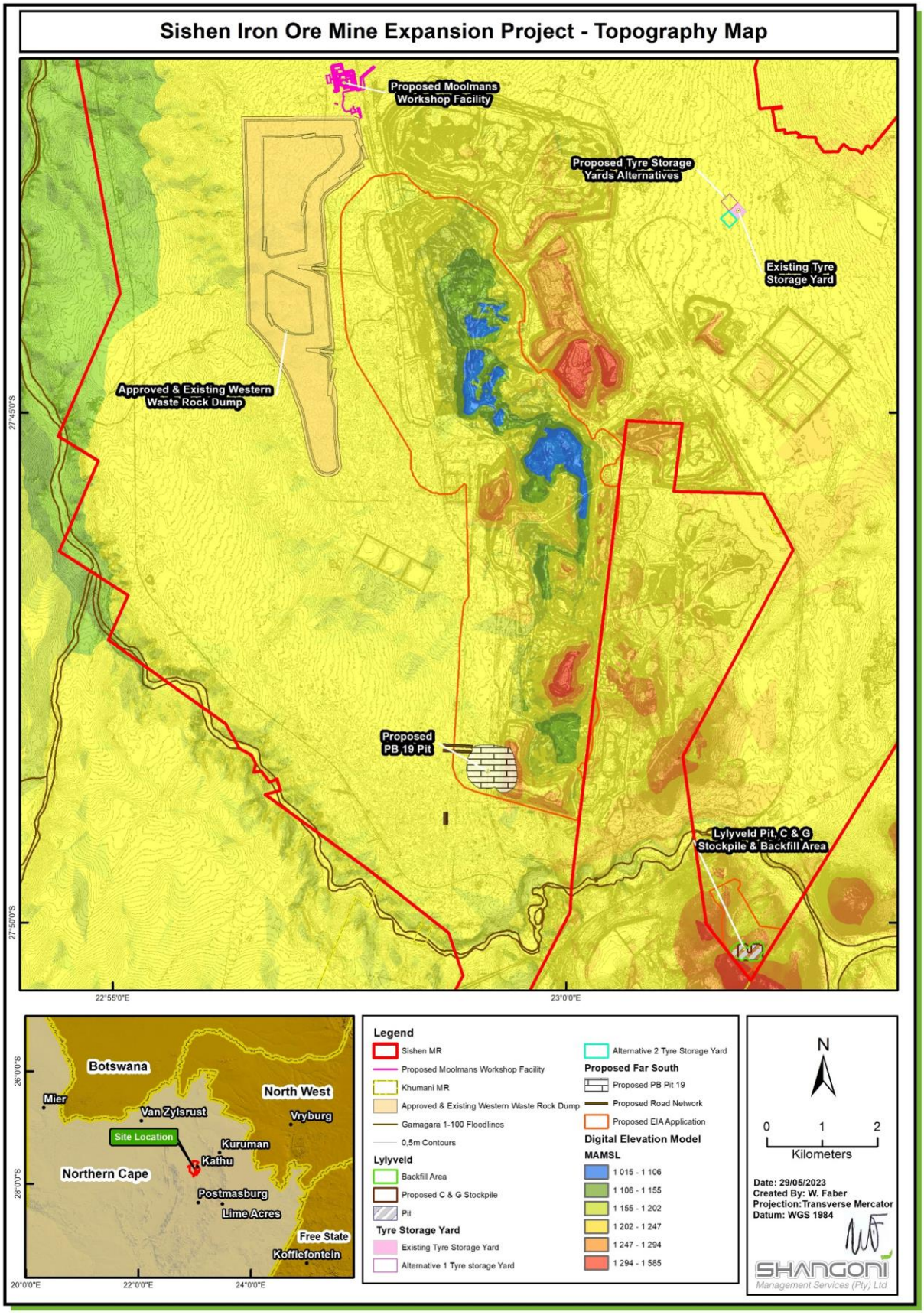


*Figure 14: Map showing topography of the proposed Sishen Expansion Project*

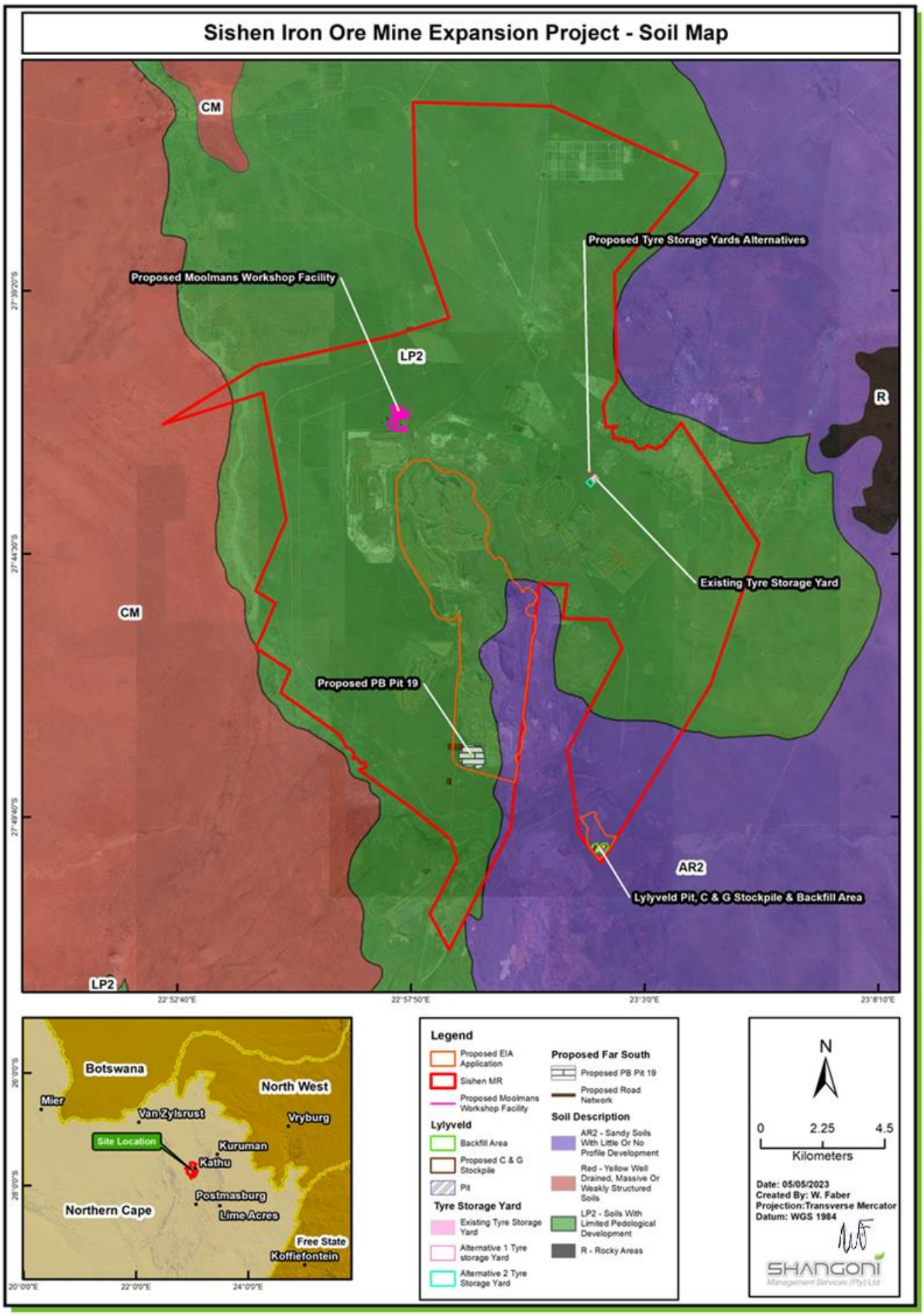


*Figure 15: Map showing soils associated with of the proposed Sishen Expansion Project*

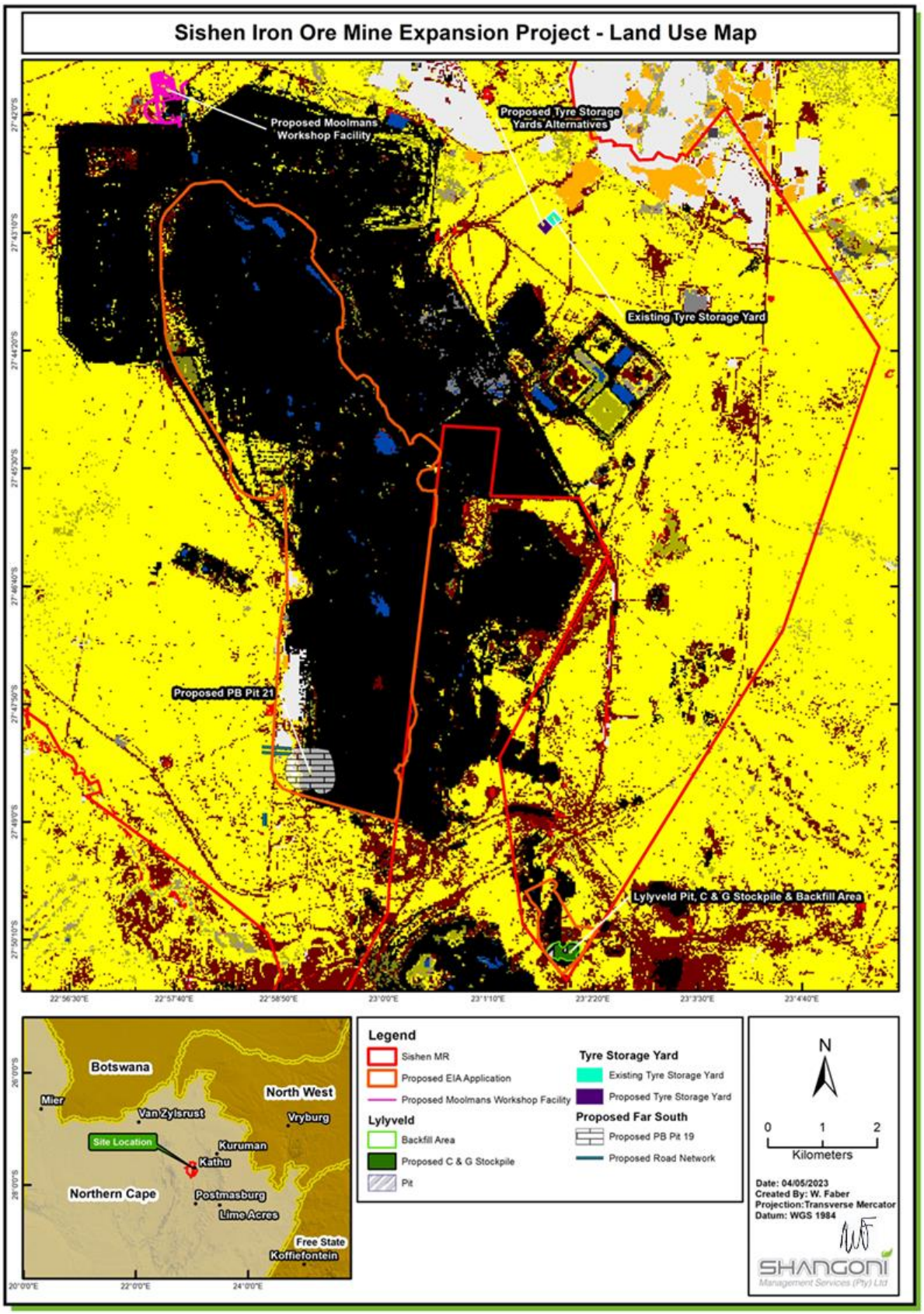


*Figure 16: Map showing land use associated with of the proposed Sishen Expansion Project*

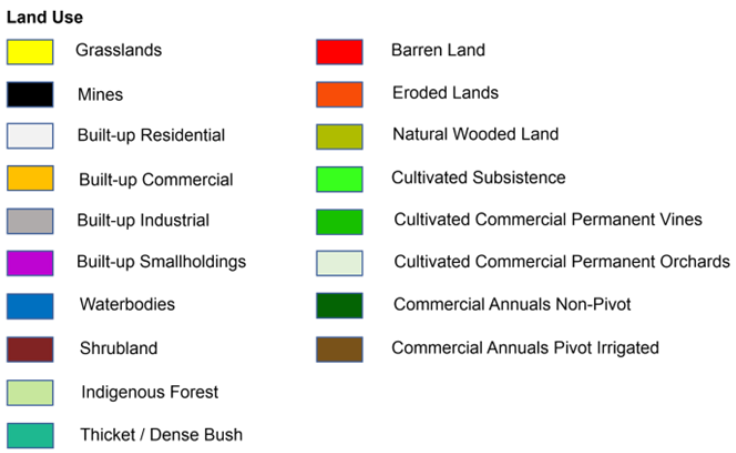


*Figure 17: Legend for land use map*

## Chapter E: Vegetation

The following information was sourced from the *Terrestrial Biodiversity Impact Assessment for Sishen Expansion Mine Application,* compiled by Enviro-EAP dated September 2022 refer to Annexure E3.

**Main Vegetation Types**

The vegetation map of South Africa, Lesotho, and Swaziland (Mucina, Rutherford & Powrie, 2005 and updated in 2009) indicates that the entire area of the SIMS study site falls within the widespread vegetation type known as Kathu Bushveld, a Least Threatened vegetation type (Government Gazette, 2011; Driver et al. 2011).

Kathu Bushveld is a vegetation type within the Savannah Biome, Eastern Kalahari Bushveld Bioregion, of southern Africa. According to Rutherford et al. 2006 it extends from Kathu and Dibeng in the south to through Hotazel to Frylinckspan near the Botswana border at an altitudinal range of 960 – 1 300 m above mean sea level. Depending on location it may have a stratum of tall trees, usually Vachellia erioloba (camel thorn), or there may be a stratum of small trees most often dominated by Vachellia mellifera subsp. detinens. Boscia albitrunca (Shepherds' tree) and Terminalia sericea (silver cluster-leaf) also contribute to the small tree stratum in places. A third stratum of tall shrubs is usually found and is the most prominent stratum with a fourth stratum also present consisting of low shrubs, grasses, and forbs usually less than 1 m tall. Refer to Figure 18.

**Threatened Ecosystems, Including Listed Ecosystems**

The conservation status of SVk12 is Least Threatened. A conservation target of 16% is envisioned by conservation authorities, but to date no portion of SVk12 is statutorily conserved. More than 1% is totally transformed by mainly mining activities and settlements. This vegetation type resembles the description of Acocks' (1953) Kalahari Thornveld and Shrub Bushveld (VT 16) and also the description in Low and Rebelo (1996) of Kalahari Plains Thorn Bushveld (LR 30).

**Ecological Connectivity, Habitat Fragmentation, Ecological Processes and Fine-Scale Habitats**

The current status of the area is fragmented by prospecting drill sites; mining activities, access roads; past land management fences and tracks; livestock overgrazing; and alien species encroached areas. The fauna and flora diversity observed is greater than expected considering these impacts.

The site has a moderate abundance of nationally protected trees (*Vachellia erioloba* and *Boscia albitrunca*) and it is expected that approximately 842 trees will be lost. Little other protected flora was observed on-site. Suitable bulb habitats are noted and should be considered in terms of DENC flora permits and during search and rescue. Evidence of several protected fauna and herpetofauna were observed. Relatively high fauna activity occurred around the sensitive habitats (wetlands), especially at the C&G Stockpile areas.

In terms of landscape connectivity, the site is fragmented and directly adjacent to the mine, impacts on faunal movements is low and linkages between other sensitive habitats limited. Ecological support areas ("ESA"), with smaller potions indicated as other natural area ("ONA") were mapped at the proposed mine expansion areas. During the site assessment it was evident that for the most part, this designation is incorrect. The degraded habitat due to disturbances and alteration of vegetation structure and species composition no longer meets the requirements for an ESA. The remaining portion of the Kathu Bushveld however can still be considered representative of an ESA. This habitat unit did however provide habitat for a number of species and can be considered representative of the Kathu Bushveld vegetation type, a Least Threatened Vegetation type as per the National Biodiversity Assessment (2018). Some of the expansion areas is however degraded bushveld and was severely altered from the reference Kathu Bushveld as a result of historic and ongoing mining activities and cannot be considered representative of the Kathu Bushveld. The transformed habitat has been completely transformed comprising of no vegetation, or where vegetation was observed was limited to Alien Invasive Plant Species ("AIP").

**Species, Distribution, Important Habitats**

<u>Vegetation Characteristics and Description</u>

The landscape is mostly flat with some small, interspersed pans. The main vegetation features include a medium-tall tree layer with mostly *Boscia albitrunca*, but also *Vachellia erioloba* in places, as the prominent trees. The shrub layer is generally most important with, for example, *Vachellia mellifera* subsp. *detinens, Diospyros lycioides* and *Lycium hirsutum*. The grass layer is variable in cover. The most important trees and shrubs are *Vachellia erioloba, V. mellifera* subsp*. detinens, Boscia albitrunca, Diospyros lycioides* subsp. *lycioides, Grewia flava, G. retinervis, Gymnosporia buxifolia, Lycium hirsutum* and *Rhigozum brevispinosum*. Dominant and other grasses include *Aristida meridionalis, A. congesta, Brachiaria nigropedata, Centropodia glauca, Eragrostis lehmanniana, E. biflora, E. chloromelas, E. heteromera, E. pallens, Melinis repens, Schmidtia pappophoroides, S. kalahariensis, Stipagrostis ciliata, S. uniplumis* and *Tragus berteronianus.* Significant low shrubs and herbs are *Aptosimum decumbens, Acrotome inflata, Erlangea misera, Gisekia africana, Heliotropium ciliatum, Hermbstaedtia fleckii, H. odorata, Limeum fenestratum, L. viscosum, Lotononis platycarpa, Nolletia arenosa, Senna italica, Sida cordifolia, Tragia dioica and Tribulus terrestris*. Biogeographically important

species include the Kalahari endemics *Vachellia luederitzii var. luederitzii* (small tree), *Anthephora argentea, Megaloprotachne albescens, Panicum kalahariense* (grasses) and *Neuradopsis bechuanensis* (herb).

The following floral SCC ("SCC") (comprising of species under the National Forests Act (No 84 of 1998) ("NFA"), Northern Cape Nature Conservation Act (no 9 of 2009) ("NCNCA") and National Environmental Management: Biodiversity Act 10 of 2004 ("NEMBA") as per the national and provincial protected species regulations were observed within the study area:

- The NFA:
  - *Vachellia erioloba*;
- The NCNCA:
  - Schedule 2 – Protected Species: *Aloe grandidentata.*

Additionally, the following floral SCC are considered to have an increased probability of occurring within the Kathu Bushveld Habitat:

- *Boophone disticha* (NCNCA Schedule 2 – Protected);
- *Harpagophytum procumbens* (NEM:BA TOPS - Protected); and
- *Nerine laticoma* (NCNCA Schedule 2 – Protected Species).

No ecosystems that are threatened and in need of protection according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) was recorded in or in the vicinity of the study area.

None of the species listed in the environmental screen tool report were observed or recorded on site at the time of the surveys.

Refer to Table 8 and Table 9 for a list of possible protected and plant species occurring within the study area.

*Table 8: Possible list of protected plant species occurring in the study area*

| Species Name | Family | Growth Form | Species Status | Vu | |
|---|---|---|---|---|---|
| | | | | 1 | 2 |
| *Vachellia erioloba* | *Fabaceae* | Tree | D, P(SA) | X | |
| *Ammocharis coranica* | *Amaryllidaceae* | Geophyte | P(NC) | X | X |
| *Asclepias aurea* | *Apocynaceae* | Geophytic herb | P(NC) | X | |
| *Boscia albitrunca* | *Capparaceae* | Tree | P(SA), P(NC) | X | |
| *Crinum* c.f. *macowanii* | *Amaryllidaceae* | Geophyte | D, P(NC) | X | |
| *Gomphocarpus fruticosus* subsp. *fruticosus* | *Apocynaceae* | Herbaceous shrub | P(NC) | X | X |
| *Gymnosporia buxifolia* | *Celastraceae* | Tree | P(NC) | X | X |
| *Nerine laticoma* | *Amaryllidaceae* | Geophyte | P(NC) | X | |
| *Oxalis* species | *Oxalidaceae* | Geophyte | P(NC) | X | |
| *Pergularia daemia* | *Apocynacea* | Herb, climber | P(NC) | X | |

Note: abbreviations used are as follows:

*D – Declining (Raimondo et al, 2009); P(SA) – nationally protected tree species (NFA, 1998); P(NC) – provincially protected species (NCNCA, 2009).*

*Table 9: Species list downloaded from POSA (http://posa.sanbi.org) for QDS 2722 DB & DD*

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Acanthaceae* | *Barleria macrostegia Nees* | LC | No | Perennial | Herb |
| *Acanthaceae* | *Barleria rigida Nees* | LC | No | Perennial | Dwarf shrub, shrub |
| *Acanthaceae* | *Justicia puberula Immelman* | LC | No | Perennial | Dwarf shrub, herb |
| *Acanthaceae* | *Justicia thymifolia (Nees) C.B.Clarke* | LC | No | Perennial | Dwarf shrub, shrub |
| *Acanthaceae* | *Monechma divaricatum (Nees) C.B.Clarke* | LC | No | Perennial | Shrub, suffrutex |
| *Acanthaceae* | *Monechma incanum (Nees) C.B.Clarke* | LC | No | Perennial | Dwarf shrub, shrub |
| *Amaranthaceae* | *Aerva leucura Moq.* | LC | No | Perennial | Herb |
| *Anacardiaceae* | *Searsia tridactyla (Burch.) Moffett* | LC | No | Perennial | Shrub, tree |
| *Apocynaceae* | *Fockea angustifolia K.Schum.* | LC | No | Perennial | Climber, succulent |
| *Apocynaceae* | *Acokanthera oppositifolia (Lam.) Codd* | LC | No | Perennial | Shrub, tree |
| *Apocynaceae* | *Piaranthus decipiens (N.E.Br.) Bruyns* | LC | No | Perennial | Succulent |
| *Asparagaceae* | *Asparagus suaveolens Burch.* | LC | No | Perennial | Shrub |
| *Asphodelaceae* | *Aloe hereroensis Engl. var. hereroensis* | LC | No | Perennial | Dwarf shrub, succulent |
| *Asphodelaceae* | *Bulbine narcissifolia Salm-Dyck* | LC | No | Perennial | Geophyte, herb, succulent |
| *Asteraceae* | *Arctotis leiocarpa Harv.* | LC | No | Perennial | Herb |
| *Asteraceae* | *Eriocephalus ericoides (L.f.) Druce subsp. griquensis M.A.N.Müll.* | LC | No | Perennial | Shrub |
| *Asteraceae* | *Arctotheca calendula (L.) Levyns* | LC | No | Annual | Herb |
| *Asteraceae* | *Chrysocoma ciliata L.* | LC | No | Perennial | Shrub |
| *Asteraceae* | *Cineraria lyratiformis Cron* | LC | No | Annual (occ. perennial) | Herb |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Asteraceae* | *Dicoma anomala Sond. subsp. gerrardii (Harv. ex F.C.Wilson) S.Ortíz & Rodr.Oubiña* | LC | No | Perennial | Herb |
| *Asteraceae* | *Dicoma capensis Less.* | LC | No | Perennial | Herb |
| *Asteraceae* | *Dicoma macrocephala DC.* | LC | No | Perennial | Herb |
| *Asteraceae* | *Felicia muricata (Thunb.) Nees subsp. muricata* | LC | No | Perennial | Shrub |
| *Asteraceae* | *Helichrysum argyrosphaerum DC.* | LC | No | Annual | Herb |
| *Asteraceae* | *Helichrysum cerastioides DC. var. cerastioides* | LC | No | Perennial | Herb |
| *Asteraceae* | *Helichrysum pumilio (O.Hoffm.) Hilliard & B.L.Burtt subsp. pumilio* | LC | No | Perennial | Dwarf shrub, herb |
| *Asteraceae* | *Helichrysum zeyheri Less.* | LC | No | Perennial | Dwarf shrub, shrub |
| *Asteraceae* | *Hertia pallens (DC.) Kuntze* | LC | No | Perennial | Shrub, succulent |
| *Asteraceae* | *Ifloga glomerata (Harv.) Schltr.* | LC | No | Annual | Herb |
| *Asteraceae* | *Lopholaena cneorifolia (DC.) S.Moore* | LC | No | Perennial | Shrub, succulent |
| *Asteraceae* | *Metalasia trivialis P.O.Karis* | LC | No | Perennial | Shrub |
| *Asteraceae* | *Pentzia incana (Thunb.) Kuntze* | LC | No | Perennial | Shrub |
| *Asteraceae* | *Pentzia viridis Kies* | LC | No | Perennial | Shrub, suffrutex |
| *Asteraceae* | *Tarchonanthus camphoratus L.* | LC | No | Perennial | Shrub, tree |
| *Asteraceae* | *Tarchonanthus obovatus DC.* | LC | No | Perennial | Shrub, tree |
| *Asteraceae* | **Verbesina encelioides (Cav.) Benth. & Hook. var. encelioides* | Not Evaluated | No | Annual | Herb |
| *Bignoniaceae* | *Rhigozum brevispinosum Kuntze* | LC | No | Perennial | Shrub |
| *Boraginaceae* | *Ehretia rigida (Thunb.) Druce subsp. rigida* | LC | No | Perennial | Shrub, tree |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Capparaceae* | *Boscia foetida Schinz subsp. foetida* | LC | No | Perennial | Shrub, tree |
| *Celastraceae* | *Putterlickia pyracantha (L.) Szyszyl.* | LC | No | Perennial | Shrub |
| *Chenopodiaceae* | **Chenopodium carinatum R.Br.* | Not Evaluated | No | Annual | Herb |
| *Chenopodiaceae* | *Chenopodium hederiforme (Murr) Aellen var. undulatum Aellen* | LC | No | Annual | Herb |
| *Chenopodiaceae* | *Exomis microphylla (Thunb.) Aellen var. axyrioides (Fenzl) Aellen* | LC | No | Perennial | Shrub |
| *Colchicaceae* | *Colchicum melanthoides (Willd.) J.C.Manning & Vinn. subsp. melanthoides* | LC | No | Perennial | Geophyte |
| *Convolvulaceae* | *Evolvulus alsinoides (L.) L.* | LC | No | Annual (occ. perennial) | Herb |
| *Convolvulaceae* | *Ipomoea oenotheroides (L.f.) Raf. ex Hallier f.* | LC | No | Perennial | Shrub, succulent |
| *Cucurbitaceae* | *Kedrostis crassirostrata Bremek.* | LC | No | Perennial | Climber, herb, succulent |
| *Cucurbitaceae* | *Momordica balsamina L.* | LC | No | Perennial | Climber, herb, succulent |
| *Cyperaceae* | *Schoenoplectus muricinux (C.B.Clarke) J.Raynal* | LC | No | Perennial | Cyperoid, emergent hydrophyte, helophyte |
| *Dipsacaceae* | *Scabiosa buekiana Eckl. & Zeyh.* | LC | No | Perennial | Herb |
| *Dracaenaceae* | *Sansevieria aethiopica Thunb.* | LC | No | Perennial | Geophyte, succulent |
| *Ebenaceae* | *Euclea undulata Thunb.* | LC | No | Perennial | Shrub, tree |
| *Euphorbiaceae* | *Clutia affinis Sond.* | LC | No | Perennial | Shrub |
| *Euphorbiaceae* | *Croton gratissimus Burch. var. gratissimus* | LC | No | Perennial | Shrub, tree |
| *Euphorbiaceae* | *Euphorbia avasmontana Dinter var. avasmontana* | LC | No | Perennial | Shrub, succulent |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Euphorbiaceae* | *Euphorbia inaequilatera Sond. var. inaequilatera* | LC | No | Annual | Dwarf shrub, herb |
| *Euphorbiaceae* | *Euphorbia juttae Dinter* | | No | Perennial | Dwarf shrub, succulent |
| *Fabaceae* | *Vachellia haematoxylon Willd.* | LC | No | Perennial | Shrub, tree |
| *Fabaceae* | *Lotononis crumanina Burch. ex Benth.* | LC | No | Perennial | Herb |
| *Fabaceae* | *Vachellia erioloba E.Mey.* | Declining | No | Perennial | Shrub, tree |
| *Fabaceae* | *Vachellia hebeclada DC. subsp. hebeclada* | LC | No | Perennial | Shrub, tree |
| *Fabaceae* | *Vachellia karroo Hayne* | LC | No | Perennial | Shrub, tree |
| *Fabaceae* | *Calpurnia aurea (Aiton) Benth. subsp. aurea* | LC | No | Perennial | Shrub, tree |
| *Fabaceae* | *Cullen tomentosum (Thunb.) J.W.Grimes* | LC | No | Perennial | Herb |
| *Fabaceae* | *Cyamopsis serrata Schinz* | LC | No | Annual | Herb |
| *Fabaceae* | *Indigofera alternans DC. var. alternans* | LC | No | Perennial | Herb |
| *Fabaceae* | *Indigofera daleoides Benth. ex Harv. var. daleoides* | LC | No | Perennial | Herb |
| *Fabaceae* | *Indigofera rhytidocarpa Benth. ex Harv. subsp. rhytidocarpa* | LC | No | Annual | Herb |
| *Fabaceae* | *Indigofera sessilifolia DC.* | LC | No | Perennial | Dwarf shrub, herb |
| *Fabaceae* | *Lotononis parviflora (P.J.Bergius) D.Dietr.* | LC | No | Annual | Herb |
| *Fabaceae* | *Melolobium calycinum Benth.* | LC | No | Perennial | Dwarf shrub, shrub |
| *Fabaceae* | *Melolobium canescens Benth.* | LC | No | Perennial | Dwarf shrub, shrub |
| *Fabaceae* | *Melolobium humile Eckl. & Zeyh.* | LC | No | Perennial | Dwarf shrub |
| *Fabaceae* | *Ptycholobium biflorum (E.Mey.) Brummitt subsp. biflorum* | LC | No | Perennial | Dwarf shrub, herb |
| *Fabaceae* | *Senna italica Mill. subsp. arachoides (Burch.) Lock* | LC | No | Perennial | Herb |
| *Fabaceae* | *Sutherlandia frutescens (L.) R.Br.* | LC | No | Perennial | Dwarf shrub, shrub |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Fabaceae* | *Tephrosia dregeana E.Mey. var. dregeana* | LC | No | Annual (occ. perennial) | Dwarf shrub, herb |
| *Gisekiaceae* | *Gisekia africana (Lour.) Kuntze var. africana* | LC | No | Annual (occ. perennial) | Herb |
| *Iridaceae* | *Moraea pallida (Baker) Goldblatt* | LC | No | Perennial | Geophyte, herb |
| *Juncaceae* | *Juncus dregeanus Kunth subsp. dregeanus* | LC | No | Perennial | Helophyte, herb |
| *Lamiaceae* | *Acrotome inflata Benth.* | LC | No | Annual | Herb |
| *Lamiaceae* | *Ocimum americanum L. var. americanum* | LC | No | Perennial | Herb |
| *Lobeliaceae* | *Lobelia erinus L.* | LC | No | Annual (occ. perennial) | Herb |
| *Loranthaceae* | *Tapinanthus oleifolius (J.C.Wendl.) Danser* | LC | No | Perennial | Parasite, shrub, succulent |
| *Malvaceae* | *Abutilon austro-africanum Hochr.* | LC | No | Perennial | Dwarf shrub |
| *Malvaceae* | *Grewia flava DC.* | LC | No | Perennial | Shrub |
| *Malvaceae* | *Hermannia burkei Burtt Davy* | LC | No | Perennial | Climber, herb |
| *Malvaceae* | *Hermannia comosa Burch. ex DC.* | LC | No | Perennial | Herb |
| *Malvaceae* | *Hermannia desertorum Eckl. & Zeyh.* | LC | No | Perennial | Dwarf shrub |
| *Malvaceae* | *Hermannia vestita Thunb.* | LC | No | Biennial | Dwarf shrub |
| *Malvaceae* | *Melhania rehmannii Szyszyl.* | LC | No | Perennial | Dwarf shrub |
| *Malvaceae* | *Sida cordifolia L. subsp. cordifolia* | LC | No | Annual (occ. perennial) | Dwarf shrub |
| *Malvaceae* | *Waltheria indica L.* | LC | No | Annual | Herb |
| *Menispermaceae* | *Cissampelos capensis L.f.* | LC | No | Perennial | Climber, herb, shrub |
| *Mesembryanthemaceae* | *Mestoklema arboriforme (Burch.) N.E.Br. ex Glen* | LC | No | Perennial | Succulent |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Mesembryanthemaceae* | *Trichodiadema pomeridianum L.Bolus* | LC | No | Perennial | Succulent |
| *Molluginaceae* | *Limeum myosotis H.Walter var. myosotis* | LC | No | Annual | Herb |
| *Molluginaceae* | *Limeum viscosum (J.Gay) Fenzl subsp. transvaalense Friedrich* | LC | No | Annual | Herb |
| *Molluginaceae* | *Mollugo cerviana (L.) Ser. ex DC. var. cerviana* | LC | No | Annual | Herb |
| *Neuradaceae* | *Grielum humifusum Thunb. var. parviflorum Harv.* | LC | No | Annual | Herb |
| *Orchidaceae* | *Disperis macowanii Bolus* | LC | No | Perennial | Geophyte, herb |
| *Oxalidaceae* | *Oxalis lawsonii F.Bolus* | LC | No | Perennial | Geophyte |
| *Pedaliaceae* | *Sesamum capense Burm.f.* | LC | No | Annual | Herb |
| *Poaceae* | *Cenchrus ciliaris L.* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Anthephora pubescens Nees* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Aristida congesta Roem. & Schult. subsp. congesta* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Aristida diffusa Trin. subsp. burkei (Stapf) Melderis* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Aristida engleri Mez var. engleri* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Aristida vestita Thunb.* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Brachiaria nigropedata (Ficalho & Hiern) Stapf* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Chloris virgata Sw.* | LC | No | Annual (occ. perennial) | Graminoid |
| *Poaceae* | *Cynodon incompletus Nees* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Digitaria eriantha Steud.* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Digitaria glauca Stent var. bechuanica Stent* | Not Evaluated | No | [No lifecycle defined] | Graminoid |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Poaceae* | *Digitaria seriata Stapf* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Enneapogon scaber Lehm.* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Enneapogon scoparius Stapf* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis curvula (Schrad.) Nees* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis echinochloidea Stapf* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis lehmanniana Nees var. lehmanniana* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis nindensis Ficalho & Hiern* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis porosa Nees* | LC | No | Annual | Graminoid |
| *Poaceae* | *Eragrostis trichophora Coss. & Durieu* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Eragrostis x pseud-obtusa De Winter* | Not Evaluated | No | Perennial | Graminoid |
| *Poaceae* | *Melinis nerviglumis (Franch.) Zizka* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Melinis repens (Willd.) Zizka subsp. repens* | LC | No | Annual (occ. perennial) | Graminoid |
| *Poaceae* | *Oropetium capense Stapf* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Panicum gilvum Launert* | LC | No | Annual | Graminoid |
| *Poaceae* | *Pogonarthria squarrosa (Roem. & Schult.) Pilg.* | LC | No | Perennial (occ. annual) | Graminoid |
| *Poaceae* | *Schmidtia kalahariensis Stent* | LC | No | Annual | Graminoid |
| *Poaceae* | *Schmidtia pappophoroides Steud.* | LC | No | Perennial | Graminoid |
| *Poaceae* | *Stipagrostis uniplumis (Licht.) De Winter var. uniplumis* | LC | No | Perennial (occ. annual) | Graminoid |
| *Poaceae* | *Tragus berteronianus Schult.* | LC | No | Annual | Graminoid |
| *Poaceae* | *Tragus koelerioides Asch.* | LC | No | Perennial | Graminoid |

| Family | Species | Threat status | SA Endemic | Lifecycle | Growth forms |
|---|---|---|---|---|---|
| *Poaceae* | *Urochloa panicoides P.Beauv.* | | No | Annual | Graminoid |
| *Polygalaceae* | *Muraltia alopecuroides (L.) DC.* | LC | No | Perennial | Dwarf shrub, shrub |
| *Portulacaceae* | *Talinum arnotii Hook.f.* | LC | No | Annual (occ. perennial) | Dwarf shrub, succulent |
| *Portulacaceae* | *Talinum caffrum (Thunb.) Eckl. & Zeyh.* | LC | No | Annual (occ. perennial) | Dwarf shrub, herb, succulent |
| *Portulacaceae* | *Talinum crispatulum Dinter* | LC | No | Annual (occ. perennial) | Dwarf shrub, succulent |
| *Rhamnaceae* | *Helinus spartioides (Engl.) Schinz ex Engl.* | LC | No | Perennial | Dwarf shrub |
| *Ricciaceae* | *Riccia okahandjana S.W.Arnell* | | No | Perennial | Bryophyte |
| *Rubiaceae* | *Anthospermum rigidum Eckl. & Zeyh. subsp. rigidum* | LC | No | Perennial | Dwarf shrub |
| *Scrophulariaceae* | *Jamesbrittenia integerrima (Benth.) Hilliard* | LC | No | Perennial | Dwarf shrub, herb |
| *Scrophulariaceae* | *Selago mixta Hilliard* | LC | No | Perennial | Herb |
| *Solanaceae* | *Lycium hirsutum Dunal* | LC | No | Perennial | Dwarf shrub, shrub |
| *Thymelaeaceae* | *Gnidia kraussiana Meisn. var. kraussiana* | LC | No | Perennial | Dwarf shrub, shrub |
| *Thymelaeaceae* | *Gnidia polycephala (C.A.Mey.) Gilg* | LC | No | Perennial | Dwarf shrub, herb |
| *Urticaceae* | *Laportea peduncularis (Wedd.) Chew subsp. peduncularis* | LC | No | Annual (occ. perennial) | Herb |
| *Verbenaceae* | *Chascanum pinnatifidum (L.f.) E.Mey. var. pinnatifidum* | LC | No | Perennial | Herb |
| *Verbenaceae* | *Lantana rugosa Thunb.* | LC | No | Perennial | Shrub |
| *Viscaceae* | *Viscum rotundifolium L.f.* | LC | No | Perennial | Parasite, shrub, succulent |

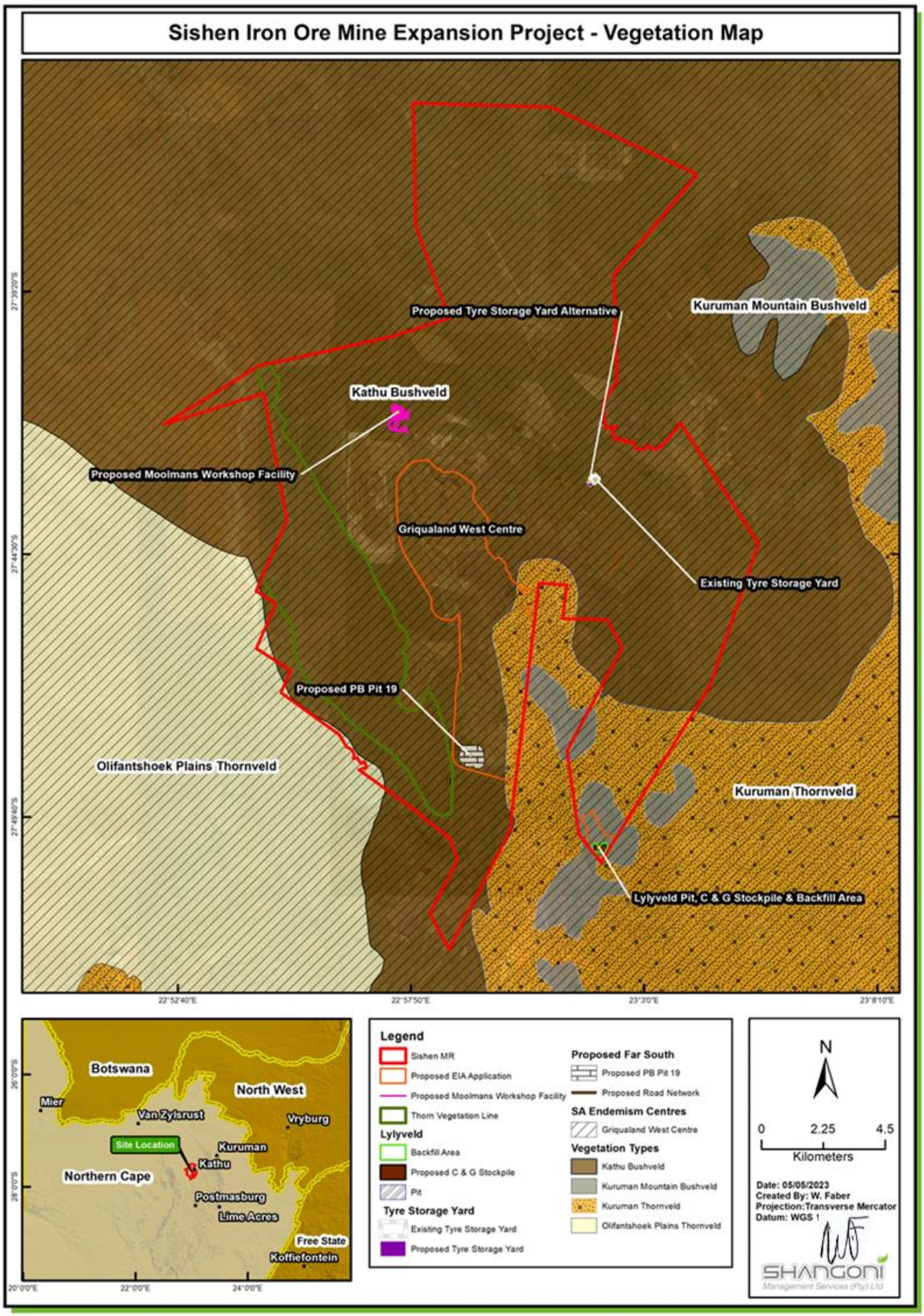


*Figure 18: Vegetation associated with the proposed Sishen Expansion Project*

## Chapter F: Fauna

The following information was sourced from the *Terrestrial Biodiversity Impact Assessment for Sishen Expansion Mine Application,* compiled by Enviro-EAP dated September 2022 refer to Annexure E3.

All fauna present within the proposed mine expansion areas were identified through visual observations, ecological indicators (tracks, dung, burrowing, etc) and species-specific calls (birds). Species, or signs thereof, observed during the site assessment include, but are not limited to: *Raphicerus campestris* (Steenbok), *Cynictis penicillate* (Yellow mongoose), *Herpestes sanguineus* (Slender Mongoose), *Danaus chrysippus* (African Monarch), *Falco rupicolus* (Rock Kestrel), *Threskiornis aethiopicus* (African sacred ibis), *Streptopelia semitorquata* (red-eyed dove), *Streptopelia capicola* (The Ring-necked Dove), *Corvus albus* (Pied Crow), *Apus affinis* (Little Swift), *Papio ursinus* (Chacma baboon), *Sylvicapra grimmia* (Duiker), *Variable Skink Trachylepis varia* and *Tragelaphus strepsiceros* (Greater Kudu). Refer to Table 10, Table 11 and Table 12.

*Table 10: Confirmed faunal occurrences on-site applicable to the Sishen Expansion Project*

| Scientific Name | Common Name (Eng) | IUCN 2020 | IUCN Trend | NCNCA 2012 | Range restricted |
|---|---|---|---|---|---|
| *Caracal* | Caracal | Least Concern | Unknown | Schedule 04 | N |
| *Hystrix africaeaustralis* | Cape Porcupine | Least Concern | Stable | Schedule 02 | N |
| *Lepus capensis* | Cape Hare | Least Concern | Decreasing | Schedule 02 | N |
| *Lepus saxatilis* | Scrub Hare | Least Concern | Decreasing | Schedule 02 | N |
| *Orycteropus afer* | Aardvark | Least Concern | Unknown | Schedule 01 | N |
| *Papio ursinus* | Chacma baboon | Least Concern | Decreasing | Schedule 04 | N |
| *Phacochoerus africanus* | Common Warthog | Least Concern | Decreasing | Schedule 02 | N |
| *Raphicerus campestris* | Steenbok | Least Concern | Stable | Schedule 02 | Y |
| *Tragelaphus strepsiceros* | Greater Kudu | Least Concern | Stable | Schedule 02 | N |
| *Xerus inauris* | African Ground Squirrel | Least Concern | Stable | Schedule 02 | N |

**Mammals**

The mammalian community at the project site is likely to be of moderate diversity; although more than 50 species of terrestrial mammals are known from the wider area, the extent and habitat diversity of the project site is too low to support a very wide range of mammals.

Species observed (in bolt) or otherwise confirmed present in the area include Aardvark, Cape Porcupine, Springhare, South African Ground Squirrel, Scrub hare, Vervet Monkey, Small-spotted Genet, Yellow Mongoose, Slender Mongoose, Black-Backed Jackal, Steenbok, Duiker and Kudu. Small mammals known to be present in areas close to the study area are Desert Pygmy Mouse *Mus indutus,* Multimammate Mouse *Mastomys coucha,* Bushveld Gerbil *Tatera leucogaster,* Hairy footed Gerbil

*Gerbillurus paeba*, Pouched Mouse *Saccostomus campestris* and Grey Climbing Mouse *Dendromus melanotis.*

Five listed terrestrial mammal species potentially occur in the area; these are the Brown Hyaena *Hyaena brunnea* (Near Threatened), Black-footed Cat *Felis nigripes* (Vulnerable), Leopard *Panthera pardus* vulnerable ("VU"), Ground Pangolin *Smutsia temminckii* (Vulnerable) and South African Hedgehog *Atelerix frontalis* (Vulnerable). The Leopard and Brown Hyaena are not likely to occur in the area on account of the mining land-use in the area which is not usually conducive to the persistence of large carnivores. The Black-footed Cat is a secretive species which would be likely to occur in the wider area, but not at the project site given that it occurs within arid, open country. The Hedgehog and Ground Pangolin is also unlikely to occur in the area and will be in the bigger area present at typically low densities. Given the extensive national ranges of these species, the impact of the proposed development on habitat loss for these species would be minimal and a long-term impact on these species would be unlikely.

*Table 11: Confirmed avifaunal occurrences on site applicable to the Sishen Expansion Project*

| Scientific Name | Common Name (Eng) | IUCN 2020 | IUCN Trend | NCNCA 2012 | Range Restricted |
|---|---|---|---|---|---|
| *Afrotis afraoides* | Northern Black Bustard | Least Concern | Stable | Schedule 02 | N |
| *Alopochen aegyptiaca* | Egyptian Goose | Least Concern | Decreasing | Schedule 02 | N |
| *Amadina erythrocephala* | Red Headed Finch | Least Concern | Stable | Schedule 02 | N |
| *Anthoscopus minutus* | Cape Penduline Tit | Least Concern | Stable | Schedule 02 | N |
| *Apus affinis* | Little Swift | Least Concern | Increasing | Schedule 02 | N |
| *Burhinus capensis* | Spotted Thick Knee | Least Concern | Stable | Schedule 02 | N |
| *Colius* | White-backed Mousebird | Least Concern | Increasing | Schedule 03 | N |
| *Corvus albus* | Pied Crow | Least Concern | Stable | Schedule 03 | N |
| *Granatina* | Violet-eared Waxbill | Least Concern | Stable | Schedule 02 | N |
| *Lophoceros nasutus* | African Grey Hornbill | Least Concern | Stable | Schedule 02 | N |
| *Merops apiaster* | European Bee-eater | Least Concern | Stable | Schedule 02 | N |
| *Numida meleagris* | Helmeted Guineafowl | Least Concern | Stable | Schedule 02 | N |
| *Oena capensis* | Namaqua Dove | Least Concern | Increasing | Schedule 02 | N |
| *Plocepasser mahali* | White Browed Sparrow- weaver | Least Concern | Stable | Schedule 02 | N |
| *Pterocles burchelli* | Burchell's Sandgrouse | Least Concern | Stable | Schedule 02 | N |
| *Streptopelia capicola* | Ring-necked Dove | Least Concern | Increasing | Schedule 02 | N |

| Scientific Name | Common Name (Eng) | IUCN 2020 | IUCN Trend | NCNCA 2012 | Range Restricted |
|---|---|---|---|---|---|
| *Streptopelia senegalensis* | Laughing dove | Least Concern | Stable | Schedule 02 | N |
| *Tockus leucomelas* | Southern, Yellow-Billed Hornbill | Least Concern | Decreasing | Schedule 02 | N |
| *Turdoides bicolor* | Southern Pied Babbler | Least Concern | Decreasing | Schedule 02 | N |

**Avifauna**

A population of Little Swifts (*Apus affinis*) were recorded at the time of the survey. Little swifts are protected under the NCNCA Act (Act No. 9 of 2009), and these birds are often resident, although some populations are migratory. Even migratory Little Swifts will, however, return to the same site year after year.

*Table 12: Confirmed herpetofauna occurrences on-site applicable to the Sishen Expansion Project*

| Scientific Name | Common Name (Eng) | IUCN 2020 | IUCN Trend | NCNCA 2012 | Range Restricted |
|---|---|---|---|---|---|
| *Chamaeleo dilepis* | Common African Flap-necked chameleon | Least Concern | Stable | Schedule 01 | N |
| *Naja nivea* | Cape Cobra | NA | NA | Schedule 03 | Y |
| *Pedioplanis lineoocellata* | Spotted sand lizard | NA | NA | Schedule 02 | N |
| *Stichmochelys pardalis* | Leopard Tortoise | NA | NA | Schedule 02 | N |

**Reptiles**

The project site lies in or near the distribution range of more than 50 reptile species, although many of these are unlikely to occur at the project site as it is restricted largely to sandy substrate and does not include rocky habitat or other habitats that are important for reptiles. Protected herpetofauna (*Chamaleo dilepis* is specially protected under the NCNCA Act (Act No. 9 of 2009) were observed at the C&G Stockpile site.

Species observed during survey (in bolt) on in the immediate area in the past include Serrated Tent Tortoise *Psammobates oculifer,* Cape Cobra *Naja nivea*, Ground Agama *Agama aculeata,* Spotted Sand Lizard *Pedioplanis lineoocellata,* Variable Skink *Trachylepis varia,* Bibron's Blind Snake *Afrotyphlops bibronii,* Western Rock Skink *Mabuya sulcata sulcata,* Kalahari Tree Skink *Trachylepis spilogaster,* Cape Gecko *Lygodactylus capensis capensis,* Speckled Rock Skink *Trachylepis punctatissima,* Striped Skaapsteker *Psammophylax tritaeniatus,* slender mongoose *Herpestes sanguineus* and Boomslang *Dispholidus typus typus.* Impacts on reptiles are likely to be restricted

largely to habitat loss within the mining footprint. This is likely to be of local significance only as there are no very rare species or specialised habitats present within the footprint area.

**Amphibians**

The project site lies within or near the range of 10 amphibian species, indicating that the project site potentially has a moderately diverse frog community for an arid area. The pans which are present at the site would occasionally contain sufficient water for breeding purposes for those species which do not require permanent water. Tadpoles were recorded in the pans located in or close to the C&G Stockpile areas. Given the paucity of permanent water at the site, only those species which are relatively independent of water are likely to occur in the area. Species known to occur and previously observed in the area include Eastern Olive Toad *Amietophrynus garmani* and Bushveld Rain Frog *Breviceps adspersus*, both of which are unlikely to occur at the project site.

The only species of conservation concern which occurs in the wider area is the Giant Bullfrog *Pyxicephalus adspersus.* The project site lies at the margin of the known distribution of this species, and it has not been recorded from any of the quarter degree squares around the project site, suggesting that it is unlikely to occur there.

## Chapter G: Surface water

The following information was obtained from the *Sishen Iron Ore Company (Pty) Ltd: Sishen Iron Ore Mine Integrated Water and Waste Management Plan*, dated 2020 and compiled by Shangoni Management Services (Pty) Ltd.

The SIOM operation is situated within the Orange River primary catchment area and the Vaal River water management area. The Northern Cape Department of Water and Sanitation ("DWS") is the responsible water authority.

Several pans and wetlands are found in the area following rain events. Refer to Figure 19.

The Gamagara River channel can carry both the 100-year and 50-year floods, without significant flooding. Floodwaters do not reach the railway line between the southernmost section of the mine and the Gamagara River. Hence the mine workings and associated infrastructure can be regarded to be located outside the 100-year and 50-year flood lines.

Due to the episodical nature of the Gamagara River, combined with a poor gauging network, no Mean Annual Runoff ("MAR") can be established. The river is dry for possibly 97% of the time, but strong flows occur during heavy downpours, as sometimes happens during the summer rainfall season, and especially when the antecedent moisture content in the catchment is high, after successive storm events. These flows last at most for a few days before the water disappears into the riverbed along the length of the river.

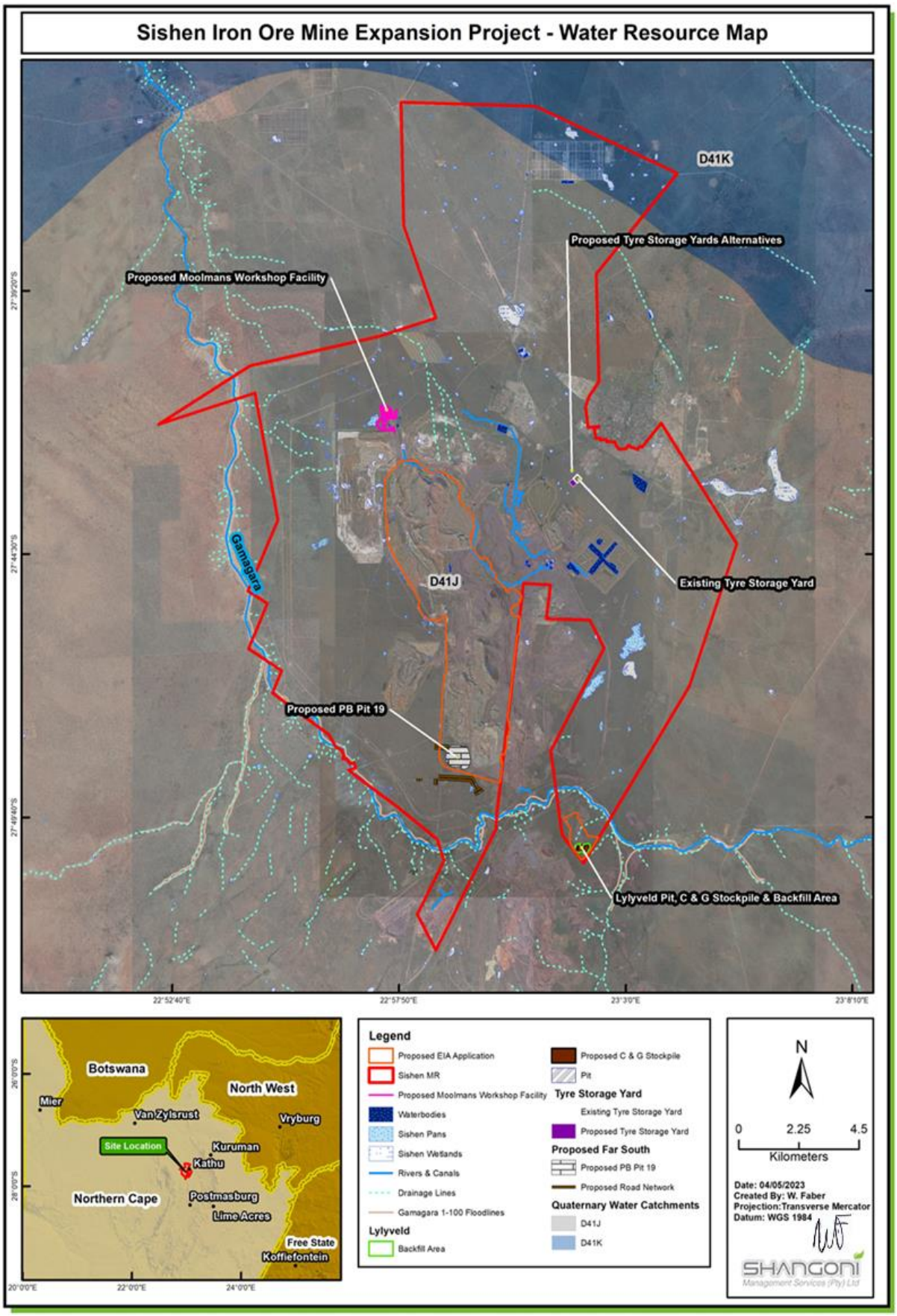


*Figure 19: Surface water resources associated with the Sishen Expansion Project*

## Chapter H: Groundwater

The following information was sourced from the *Sishen Ore Company (Pty) ltd: Sishen Iron ore Mine: Geohydrological Study and Impact Assessment for the Sishen Expansion Project – draft report,* compiled by Shangoni Management Services (Pty) Ltd, dated 2022 refer to Annexure E5.

**Hydrogeology**

Aquifer classification

The Department of Water and Sanitation ("DWS") has characterised South African aquifers based on the rock formations in which they occur together with its capacity to transmit water to boreholes drilled into specific formations. The water bearing properties of rock formations in South Africa can be classified into four classes defined as:

- Class a - Intergranular
  - Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.
- Class b - Fractured
  - Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.
- Class c - Karst
  - Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.
- Class d - Intergranular and fractured
  - Aquifers that represent a combination of Class a and b aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water are stored in the intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into the fractured aquifer.

The classes are further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in l/s. The groups therefore represent various ranges of borehole yields.

A large portion of study area is underlain by a d2 aquifer class region with the geology listed as mostly Kalahari sand and surface limestone or calcrete. The aquifer is classified as 'minor' while the groundwater yield potential is low on the basis that most of the boreholes on record produce between 0.1 and 0.5 ℓ/s.

Within the shallower and more typical aquifers, weathered zones and occasional joints and fractures in the andesitic lava and infrequent interbeds of chert and jasper, as well as basal diamictite of the Postmasburg Group can be targeted for groundwater exploration. Yields are generally low and quality of ≤ 300 mS/m may be expected.

The open pit area is mostly located on the surface shales and associated rocks of the Gamagara Formation. Shales are typically highly impermeable and such aquifers can only tap groundwater from fractures in the host rock. The primary aquifer of this layer is poorly developed and is as such classified as a b3 fractured aquifer, with medium yields of up to 2.0 ℓ/s possible in the secondary aquifer.

The deep aquifers are deeper than the clay layer and are formed by the Dwyka Formation, fractured and weathered lava, BIFs, chert and deep-seated dolomite. The chert breccias and extensive karstification of dolomite form the most important deep aquifer in the area. Deep boreholes can yield in excess of 2.0 ℓ/s and can be developed from fractures, joints and solution cavities commonly associated with faults and dolerite dykes, as well as from fractured, sub-ordinate carbonaceous shale beds. Faults and dykes can often easily be targeted due to the occurrence of calcrete mounds and trees along these structures. Outcrops of dolomite to the southwest of the main pit are classed c3 or c5 karstic aquifers. Yields of >5 l/s can be achieved especially where large scale fracturing or karstic features exist, which can be classified as major aquifer systems.

**Aquifer vulnerability**

Table 13 summarizes the rating and weighting values and the final score for the vulnerability of the aquifer in vicinity of the study area. The final total DRASTI(C) score of 112 indicates that the aquifer/s in the region has a medium to high susceptibility to pollution. It must be noted that the values are based on worst case scenarios. Low recharge is expected within the overlying Kalahari but as well as into the very hard and impermeable calcrete layer (surface limestone). This together with low rainfall will protect the underlying aquifer/s from contamination. Some areas may be more weathered and more conductive than others (such as the upper Kalahari aquifer and dolomitic outcrops) and these shallow aquifers are unconfined and sensitive to contamination.

Note that due to the considerable variation in terms of hydraulic conductivity over very short distances and the absence of enough information in the hard rock aquifer, this parameter was excluded from the vulnerability estimation. Refer to Figure 20.

*Table 13: DRASTI vulnerability scores*

| Factor | Range/Type | Weight | Rating | Total |
|---|---|---|---|---|
| D | 15 - 30 m | 5 | 3 | 25 |
| R | <5 mm | 4 | 1 | 4 |
| A | Fractured and weathered | 3 | 3 | 9 |
| S | Sand-loamy sand | 2 | 7 | 14 |
| T | 0-2% | 1 | 10 | 10 |
| I | Kalahari | 5 | 10 | 50 |
| C | - | 3 | - | - |
| **DRASTI SCORE = 112** | | | | |

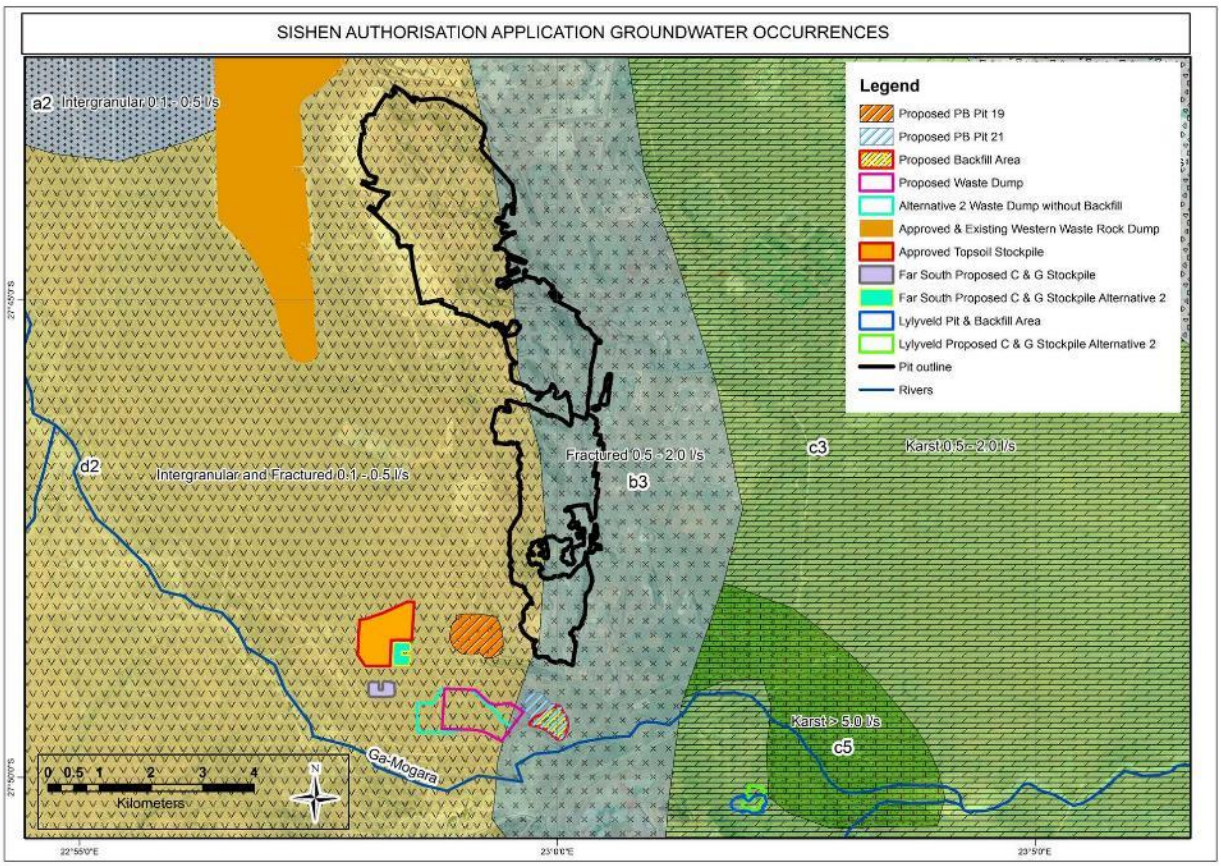


*Figure 20: Groundwater occurrences*

## Chapter I: Air Quality

The following information was obtained from the *Sishen Iron Ore Mine Dustfall Monitoring Annual Report* for 2021 compiled by Gondwana Environmental Solutions.

The nearest sensitive receptors are Dingleton, Kathu and Sesheng. Dingleton borders on the mine to the South-west; Sesheng is approximately 1 km from the northern mine boundary. Kathu is approximately 3 km to the north-west of the mine.

The prevalent winds are typically from the northerly (January to March, and December), southerly (May to September) sectors, or a combination thereof (April, October, and November). Dust sources located in areas that experienced the highest wind speeds and/or highest frequency of occurrence (above 10%) are likely to contribute to increased dustfall in the areas downwind of the sources.

Four exceedances have occurred in the last 12 months with one site recording non-permitted exceedance of the Non-Residential Standard (1,200 mg/m$^2$/day). The Residential Standard (600 mg/m2/day) was not exceeded during 2021. The dustfall network is currently 97% compliant. Seasonal variations indicate the highest dustfall occurs during Spring, which coincides with the highest wind speeds.

## Chapter J: Noise

The following information was obtained from the *Summer Environmental Noise Assessment Sishen Mine* November 2021 and *Winter Environmental Noise Assessment Sishen Mine* 2021 compiled by dBAcoustics.

There were three types of noise sources such as a continuous source (hauling vehicles and traffic inside the mining area), point source (pit activities, crushers, and processing plant noise) and a finite type of noise (train and blasting activities) within the Sishen mining right area. These mining related operations resulted in an increase in the prevailing environmental ambient noise levels in certain areas.

The pre-vailing ambient noise levels for the different Sishen Mine study areas are however in line with the recommended noise levels as prescribed in SANS 10103 of 2008 and the Health and Safety Regulations of the International Finance Corporation of the World Bank.

## Chapter K: Archaeology and Cultural History

The following information was obtained from the. *1st phase H.I.A. of a proposed extension and upgrading at Sishen Mine, also known as the Sishen Iron Ore Mine Expansion Project for Sishen Mine.* Compiled by S. Miller. 2022 refer to Annexure E7.

A localised exposure of a mixture of two early stone age (“ESA”) hand axes, a small number of typical lumps, cores and blades of MSA material and a few small late stone age (“LSA”) blades was located scattered in an old quarry pit. Photos taken at 9588 (27°49'3.07"S, 22°59'45.15"E), 8101 (27°49'2.85"S, 22°59'45.63"E) and 4935 (27°49'4.56"S, 22°59'45.37"E) show where some of the lithics were found.

As the lithics are a mixture from different stone age periods, they are considered to be out of context. Also, that the quarry excavation (of unknown date) is responsible of the uncharacteristic mixture and distribution on the pit floor. Refer to Figure 21.

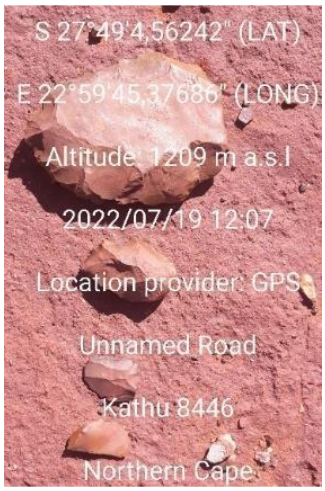


*Figure 21: A small number of lithics were found, (Photo, S.M. Miller, 2022.)*

## Chapter L: Sensitive Landscapes

The following information was obtained from the *Terrestrial Biodiversity Impact Assessment for Sishen Expansion Mine Application,* compiled by Enviro-EAP dated September 2022 refer to Annexure E2.

**Terrestrial Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs")**

According to the Northern Cape CBA (2016) database, the assessment zone is located within an area classified as an ESA while smaller areas classified as ONA and is not associated with any CBAs.

During the site assessment it was evident that for the most part, this designation is incorrect. The Degraded Habitat due to disturbances and alteration of vegetation structure and species composition no longer meets the requirements for an ESA. The remaining portion of the Kathu Bushveld however can still be considered representative of an ESA. The mine expansion and operations will not impact on the ecological processes that operate within or across the site or affect the functionality of the ESA. Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna will not be affected or altered.

**Protected Areas and Priority Areas for Protected Area Expansion**

According to the National Protected Areas Expansion Strategy (NPAES, 2009) database, the South African Protected Area Database (SAPAD, 2019) and the South African Conservation Areas Database (SACAD, 2019) the study area does not fall within a protected or conservation area or nature reserve, nor is it situated within 10 km of a formal protected area. The Kathu Bushveld vegetation type is still considered largely intact and less than 2% has been transformed by mining activity and other development. However, there has been a recent increase in mining as well as solar development within this vegetation type with the result that it has experienced significant recent habitat loss as well as become increasingly fragmented. It is also poorly conserved and does not currently fall within any formal conservation areas nor form part of the recently declared Kumba Iron Ore offset areas west of Kathu. Refer to Figure 22.

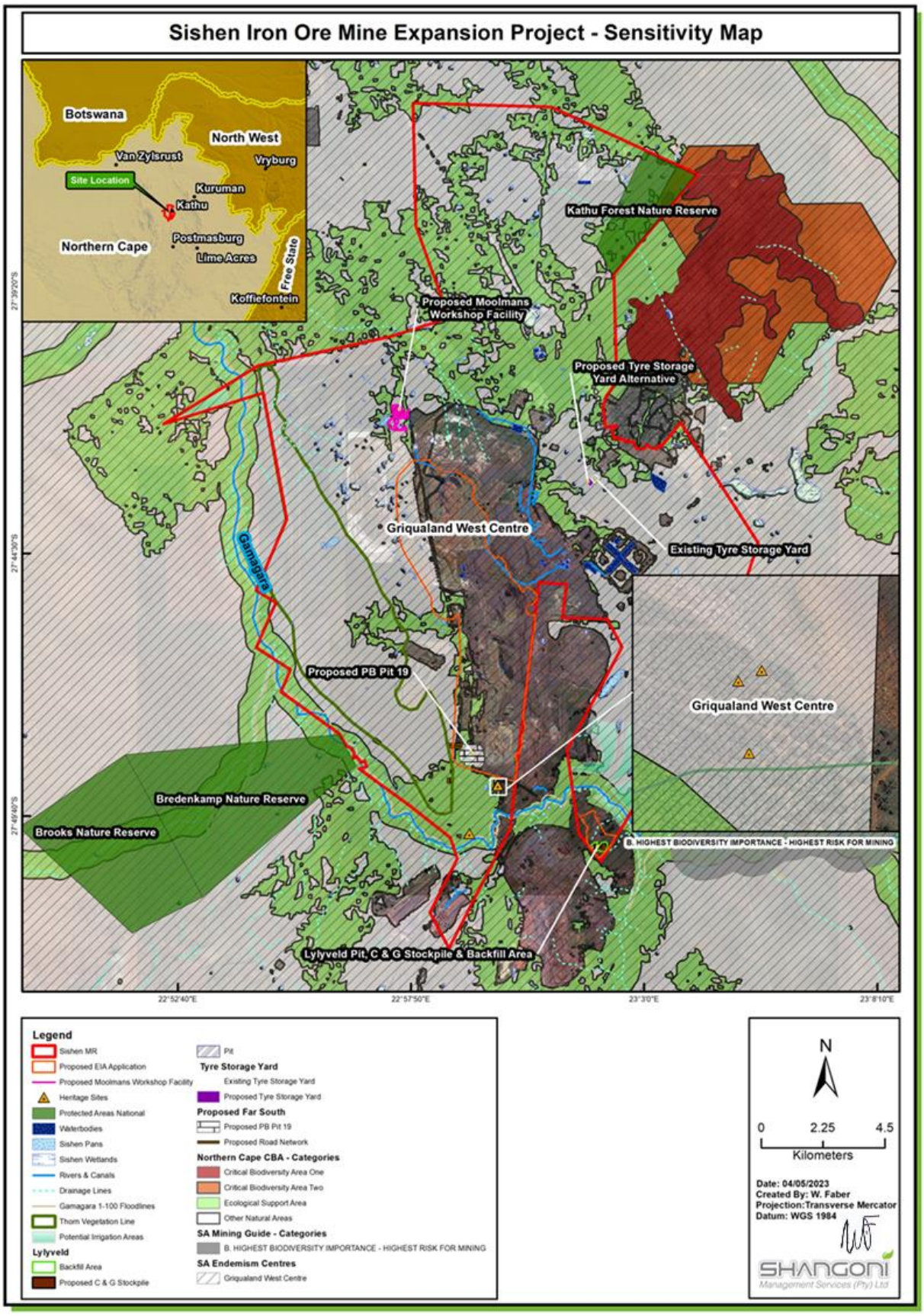


*Figure 22: Sensitivity map for the Sishen Expansion Project*

## Chapter M: Visual aspects

The following information was obtained from the *Visual Impact Assessment as part of the Environmental Impact Assessment for additional mining activities at Sishen Iron Ore Mine, near Kathu, Northern Cape Province,* compiled by Scientific Aquatic Services and dated November 2022 refer to Annexure E8.

The landscape character associated with the focus area and immediate surrounds can be described as bushveld, relatively flat terrain surrounded by the existing WRDs, stockpiles and opencast pits. Due to the relatively flat terrain of the greater region an observer can see far across the landscape, as such the existing WRDs and stockpiles associated with the various mines in the Gamagara Corridor form part of the skyline. The proposed Sishen Expansion Project will thus increase the bulk appearance of the mining dumps and not be distinguishable from them. The town of Kathu is already accustomed to the mining setting and the distance of Kathu to the proposed expansion areas renders the visual impact on the Kathu town insignificant. The level of movement within the focus area is still, with the exception of occasional mine workers, there is little to almost no movement within the focus area.

## Chapter N: Regional socio-economic structure

The following information was obtained from the *Integrated Development Plan: John Taolo Gaetsewe District Municipality,* dated 2020.

Geographically, the Northern Cape Province is the largest province in South Africa, covering an area of 372 889 km$^2$, which constitutes approximately 30% of the country's total area. Despite having the largest land mass, the province is the least populated of all nine provinces. Per Census 2016, the province's population was 1 145 859, or 2.2%, of the national population. The province is bordered by Namibia and Botswana in the north; while domestically, it is bordered by Northwest Province borders in the north-east, the Free State Province in the east, the Eastern Cape Province in the south-east, and the Western Cape Province to the south and south-west. The Northern Cape consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe.

The John Taolo Gaetsewe District Municipality ("JTGDM"), which lies in the north-east of the Northern Cape Province, is geographically the second smallest of the five district municipalities in the province, covering a surface area 27 293 km$^2$ (6% of the province). It is bordered by the Siyanda District in the east, Botswana in the north, Francis Baard District to the south, and the North-West Province in the west. The JTGDM accounts for about 16% of the provincial population.

The Gamagara Local Municipality ("LM") covers a surface area of 2 619 km$^2$, which is approximately 10% of the district's total surface area. It is located in the north-eastern sector of the Northern Cape, bordered by Ga-Segonyana LM in the east, Joe Morolong LM in the north, while Tsantsabane LM forms its south and west borders. Kathu serves as the LM's administrative centre, and it is primarily an iron ore and manganese mining area. The municipality has four major urban settlements - Kathu, Olifantshoek, Dibeng and Mapoteng/Sesheng. Dingleton was previously the fifth major settlement, but with the expansion of SIOM, residents had to be relocated, a process that began in 2014.

The following information was obtained from the *Draft Fourth Review Integrated Development Plan Gamagara Local Municipality (2021-2022).*

Gamagara Local Municipality has become a significant player in the Northern Cape Province and an important contributor to South Africa's mining sector, and international mining value chain. Thus, making it a centre of concentration on the development for providing relevant and up to date infrastructure to accommodate such development. The municipality will benefit from infrastructure investments which will drive and initiatives that have to characterise the towns economic development trajectory. The municipality has identified the economic pull and push factors, such as education and training, research, entrepreneurship, community image and the services like schooling infrastructure etc.

### 6.5.2 Description of the current land uses

Farming activities and mining are the predominant land uses type in the vicinity. The current land use for the properties associated with the proposed project is mining. Refer to Figure 16 for an illustration of land cover associated with the area.

### 6.5.3 Description of specific environmental features and infrastructure on the site

The specific environmental features on site related to flora, fauna, and wetlands have been described in the relevant chapters in Section 7.4.1 of Part A. In addition to the above, the proposed infrastructure on site is discussed in Section 4.1 of Part A.

### 6.5.4 Environmental and current land use map

Refer to the Figure 16 for an indication of the current land use and land cover.

## 6.6 Impacts and risks identified

Table 14 contains all the potential impacts and risks identified for the Sishen Expansion Project and were sourced from the relevant specialist studies conducted for the project.

### 6.6.1 Impacts and risks associated with the Sishen Expansion Project

*Table 14: Impacts and risks identified for the Sishen Expansion Project*

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| 1 | Geology | Moolmans PCD | Alternative 1 (preferred) | Construction, operation, decommissioning and closure of mining infrastructure. | Not applicable. | Irreversible | High Degree | Construction, Operational, Decommissioning and closure | 1.44 ha | 1 | 1 | Low | None | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | Not applicable. | Irreversible | High Degree | Construction, Operational, Decommissioning and closure | 4.5 ha | 1 | 1 | Low | None | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | | Unavoidable impact to geology. | Irreversible | High Degree | Construction, Operational, Decommissioning and closure | 11.30 ha (C&G stockpile) | 4 | 3 | High | Control | 3 | 3 | Medium |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Pit expansion including PB 19 | No alternatives | | | | | | 40 ha | | | | | | | |
| 2 | Topography | Moolmans PCD | Alternative 1 (preferred) | | The proposed Moolman PCD will influence the nature of the topography as the excavated material will be stockpiled at existing approved Western WRD. This increasing the height of the WRD and increasing the amount of run-off from site as the existing WRD has a higher surface area than the flat plains. | Irreversible | Medium Degree | Construction, Operational, Decommissioning and closure | 1.44 ha | 2 | 3 | Medium | Control | 2 | 2 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | The proposed Tyre expansion area will not influence the nature of the topography as the height of the Tyre expansion area will be the same as the surrounding environment. | Reversible | Medium Degree | Construction, Operational, Decommissioning and closure | 4.5 ha | 2 | 2 | Low | Control | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | | The proposed Lyleveld C&G stockpile will influence the nature of the topography as the stockpiled material will be higher than the surrounding areas increasing the amount of runoff from site as the stockpile will have a higher surface area than the flat surrounding plains as the C&G stockpile will be placed on the backfilled (total) existing pit area. | Reversible | Medium Degree | Construction, Operational, Decommissioning and closure | 11.5 ha | 4 | 3 | High | Control | 3 | 3 | Medium |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Pit expansion including PB19 | No alternatives | | Expansion of the pit will influence the topography. | Irreversible | High Degree | Construction, Operational, Decommissioning and closure | 40 ha | | | | | | | |
| 3 | Soils, land use and land capability | Moolmans PCD | Alternative 1 (preferred) | Clearing of soil | The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Reversible | Medium Degree | Construction, Decommissioning and closure | 1.44 ha | 3 | 2 | Medium | Control | 2 | 2 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | | | | Construction, Decommissioning and closure | 4.5 ha | 3 | 3 | Medium | Control and prevention | 2 | 2 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | Alternative 2 | | | | | | | 4 | 3 | High | | 3 | 3 | Medium |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | | | | Construction, Decommissioning and closure | 11.30 ha (C&G stockpile) | 3 | 3 | Medium | Control and prevention | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | 4 | 3 | High | | 3 | 2 | Medium |
| | | Pit expansion including PB 19 | No alternatives | Expanding of the pit | Expansion of the pit will cause loss of soils, causing change of land use and impact the land capability. | Irreversible | High Degree | Construction, Operational, Decommissioning and closure | 40 ha | 4 | 3 | High | Control and prevention | 3 | 2 | Medium |
| 4 | Surface water | Pit expansion and Pushback 19 | Not applicable | Initial creation of PB 19 | There may be a deterioration in surface water quality when any surface water runoff comes into contact with dust, eroded soil, or other pollutants generated during the construction phase of the Project. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered.<br>Surface water quality:<br>Siltation of water resources causes deterioration of water quality, affecting the use of surface water as a natural resource. | Irreversible | Medium Degree | Construction | 40 ha | 3 | 3 | Medium | Control and prevention | 2 | 2 | Low |
| | | Lylyveld pit expansion | Not applicable | Expanding of the pit | | Irreversible | Medium Degree | Construction | 110 ha | 3 | 3 | Medium | Control and prevention | 2 | 2 | Low |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred) | Construction of Moolmans Workshop and PCD | | Irreversible | Medium Degree | Construction | 1.44 ha | 3 | 3 | Medium | Control and prevention | 2 | 2 | Low |
| | | | PCD alternative 2 | | | | | | | | | | | | | |
| | | Moolmans haul road | Not applicable | Construction of Moolmans haul road | | Irreversible | Medium Degree | Construction | 9 ha | 3 | 2 | **Low** | Control and prevention | 2 | 1 | **Low** |
| | | Tyre expansion area | Alternative 1 (preferred) | Construction of tyre expansion | | Irreversible | Medium Degree | Construction | 4.5 ha | 3 | 3 | Low | Control and prevention | 2 | 1 | **Low** |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Pit expansion and Pushback 19 | Not applicable | Initial creation of PB 19 and expansion of the pit | Spillages of hazardous materials (i.e., cement, oil, fuel and / or grease) used during the construction phase of the Project may impact on the surrounding clean water environment.<br>Surface water quality: | Irreversible | Medium Degree | Construction | 40 ha | 3 | 3 | Medium | Control and prevention | 2 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Lylyveld pit expansion | Not applicable | Expanding of the pit | Deterioration of water quality due to chemical contamination affecting the use of surface water as a natural resource. | Irreversible | Medium Degree | Construction | 110 ha | 3 | 2 | Medium | Control and prevention | 2 | 1 | Low |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred)<br>PCD alternative 2 | Construction of Moolmans Workshop and PCD | | Irreversible | Medium Degree | Construction | 1.44 ha | 3 | 2 | Medium | Control and prevention | 2 | 1 | Low |
| | | Moolmans haul road | Not applicable | Construction of Moolmans haul road | | Irreversible | Medium Degree | Construction | 9 ha | 3 | 2 | Medium | Control and prevention | 2 | 1 | Low |
| | | Tyre expansion area | Alternative 1 (preferred)<br>Alternative 2 | Construction of tyre expansion | | Irreversible | Medium Degree | Construction | 4.5 ha | 3 | 2 | Medium | Control and prevention | 2 | 1 | Low |
| | | Pit expansion and Pushback 19 | Not applicable | Pit areas and Pushback 19 | The mine planners have identified several areas where the pit boundary will expand over the next few years. This will result in the pit boundary being expanded by an additional 40 ha. Inclusive in this pit boundary is Pushback 19 that will occupy an area of 15 ha.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Irreversible | Medium Degree | Operation | 40 ha | 4 | 3 | High | Control and prevention | 3 | 2 | Medium |
| | | Lyleveld pit | Not applicable | Lylyveld pit | It is proposed to expand the Lylyveld Pit area by 110 ha over and above the existing 15 ha area.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users | Irreversible | Medium Degree | Operation | 110 ha | 3 | 2 | Medium | Control and prevention | 2 | 2 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred)<br>PCD alternative 2 | Utilisation of Moolmans Workshop and PCD | A new workshop (Moolmans Maintenance Workshop) is proposed to be constructed close to the Nooitgedacht filling station. The workshop will occupy an area of 6.5 ha.<br>The proposed workshop area includes for several infrastructure that includes for the chemical, hydrocarbon and hydraulic storage, affected water facilities, wash bays and other infrastructure (refer to list of associated infrastructure provided in section 1.4 above. Should any spillages of hydrocarbons or affected water occur, such may pollute any clean water runoff.<br>Runoff generated upstream of the Moolmans Maintenance Workshop will drain northwards towards the facility and if left unmitigated, clean runoff could come into contact with substances that have the potential to pollute surface water (i.e., emulsion, oil, fuel and / or grease) and reduce water quality.<br>Further, the proposed Moolmans Maintenance Workshop will be constructed with an affected water management network and a PCD to contain any potentially affected water runoff.<br>Surface water quality:<br>Deterioration of surface water quality due chemical / hydrocarbon contamination resulting from leaks, spillages or bursting tanks, affecting the use of surface water as a natural resource.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Irreversible | Medium Degree | Operation | 1.44 ha | 3 | 4 | High | Control and prevention | 1 | 2 | Low |
| | | Tyre expansion area | Alternative 1 (preferred) | Tyre expansion | It is proposed to expand the existing Tyre Storage Yard by an additional 4.5 ha.<br>The expansion area will be aligned with the existing tyre storage area and constructed with a slightly elevated and concreted surface, fenced, and fitted with the appropriate fire protection management system. | Irreversible | Medium Degree | Operation | 4.5 ha | 2 | 2 | Low | Control and prevention | 1 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | Alternative 2 | | Although the tyres themselves may not result in any potential pollution of water, should the tyres be contaminated with chemicals and dust from the operation, any potential runoff from the storage area may result in decrease in the quality of surface water runoff. Further thereto, should a fire occur, chemicals and other pollutants may be released. Any surface water runoff will become contaminated.<br>Surface water quality:<br>Siltation and contaminated runoff will result in a deterioration of water quality, affecting the use of surface water as a natural resource. | | | | | | | | | | | |
| | | Lylyveld C & G stockpiles and backfilled area | Alternative 1 (preferred) | Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | It is proposed to backfill the existing extent of the Lylyveld Pit and construct a C & G Stockpile on the backfilled area.<br>The contamination is expected to be limited to predominantly red dust that has a low pollution risk. The dust discolours the storm water runoff but is inert. The stockpiling area will also contain material particles that can be suspended by runoff generated during rainfall events, increasing the sediment load of runoff and reducing surface water quality.<br>The proposed containment berm around the product stockpile will reduce surface water quality impacts but it will lead to a reduction in clean runoff water reporting to the downstream catchment.<br>Surface water quality:<br>Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. | Irreversible | Medium Degree | Operation | 11.30 ha (C&G stockpile) | 2 | 2 | Low | Control and prevention | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lylyveld pit expansion | Not applicable | Expanding of the pit | The mine planners have identified several areas where the pit boundary will expand over the next few years. This will result in the pit boundary being expanded by an additional 40 ha. Inclusive in this pit boundary is Pushback 19 that will occupy an area of 15 ha.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>However, due to the topography of the area, it is expected that clean surface water runoff will pond against the proposed berm to the west of the expansion area within a valley.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Irreversible | Medium Degree | Operation | 110 ha | 3 | 2 | Medium | Control and prevention | 2 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| 5 | Groundwater | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | The impacts on groundwater quality are primarily related to the management of materials, wastes and spills and unauthorised disposal of contaminated substances. Contamination of groundwater may also arise due to incorrect handling and disposal of waste materials. This risk is considered low. A very limited groundwater quality impact is expected during the construction phase, generally because of the small surface areas involved and the short duration thereof. | Reversible - | Low Degree - | Construction | 1.44 ha | 1 | 2 | Low | Prevent or contain groundwater contamination | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | 4.5 ha | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | 11.30 ha (C&G stockpile) | | | | | | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Pit expansion | No alternatives | Expanding the existing pit | | | | | 47 ha | | | | | | | |
| | | Lyleveld pit expansion | | Expanding the existing pit | | | | | 40 ha | | | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred) | Operating the PCD | Influx of groundwater into open voids result a subsequent lowering of groundwater levels due to dewatering with a potential loss in resource. | Reversible - | Low Degree - | Operational | 1.44 ha | Not applicable | | | Prevent or contain groundwater contamination | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Operation of the tyre storage area | | | | | 4.5 ha | 2 | 2 | Low | | 2 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Pit expansion | No alternatives | Expanding the existing pit | | | | | 40 ha | 2 | 3 | Medium | Prevent or contain groundwater contamination | 2 | 2 | Low |
| | | Lyleveld pit expansion | | | | | | | 110 ha | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | Ceasing of dewatering and rehabilitation (during closure) will lead to gradual recovery of ambient groundwater levels. However, because most remaining voids will only partially be backfilled, a gradient towards the voids will remain and therefore the re-establishment of groundwater levels, flow directions and flow gradients to near pre-mining levels will not occur. | Reversible - | Low Degree - | Decommissioning and closure | 1.44 ha | Not applicable | | | Prevent or contain groundwater contamination | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | 4.5 ha | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | 11.30 ha (C&G stockpile) | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Pit expansion | No alternatives | Expanding the existing pit | | | | | 40 h | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Lyleveld pit expansion | | | | | | | 110 ha | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | Seepage and/or stormwater run-off from the backfilled facilities can potentially result in groundwater contamination. Metals (Al, Fe and Mn) may have the potential to leach from the material, but the most significant impact expected is from major ions such as Mg, K, Na, Cl and SO4 enrichment. | Reversible | Low Degree | | 1.44 ha | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | 4.5 ha | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | 11.30 ha (C&G stockpile) | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Pit expansion | No alternatives | Cease mining in the existing pit | | | | | 40 ha | Not applicable | | | | Not applicable | | |
| | | Lyleveld pit expansion | | | | | | | 110 ha | 2 | 1 | Low | | 1 | 1 | Low |
| 6 | Biodiversity (flora) | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD. | Whole area as Other Natural Area (“ONA"). | Not irreversible | Medium Degree | Construction | 1.44 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion. | Whole area as Other Natural Area (ONA). | Irreversible | High Degree | | 4.5 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | The site is already authorised in previous application and therefore this alternative is the preferred alternative. The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br><br>Alternative 1 Approximately (whole area) 12 ha Ecological Support Area Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale. | Loss of sensitive habitats. | Irreversible | High Degree | Site clearance | 11.30 ha (C&G stockpile) | 3 | 1 | Low | Control | 3 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | Alternative 2 | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br><br>Alternative 2 Approximately 4 ha Ecological Support Area (ESA) and 8 ha Other Natural Area (ONA).<br>Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale. | | | | | 11.51 ha (C&G stockpile) | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | Lyleveld pit | No alternatives | Expanding the existing pit | Approximately 0.2 ha Other Natural Area (“ONA”) | Not reversible | Medium degree | Construction | 110 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Operation of Moolmans PCD | Whole area as Other Natural Area (“ONA”). | Not reversible | Low degree | Operation | 1.44 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Operation of the tyre storage area | | | | | 4.5 ha | 3 | 1 | Low | | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Operation of the Lyleveld C&G stockpile | | | | | 11.30 ha (C&G stockpile) | 3 | 1 | Low | | 3 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lyleveld pit | No alternatives | Expanding the existing pit | Approximately 0.2 ha Other Natural Area (ONA). | | | | 110 ha | 3 | 1 | Low | | 2 | 2 | Low |
| | | Pit expansion | No alternatives | Mining activities to enlarge the pit size | Impact on sensitive habitats and species.<br>Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site.<br>Air pollution from operational activities such as transportation of waste. | | | | 40 ha | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | The removal of natural vegetation is regarded as a significant impact. However, should rehabilitation to as close as pre-mining conditions be undertaken appropriately and adequately, as well as the control of alien invasive species, a residual impact on vegetation may be prevented. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site.<br>Air pollution from operational activities such as transportation of waste. The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Reversible | Low degree | Decommissioning and closure | 1.44 ha | Not applicable | | | Control | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | 4.5 ha | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | 11.30 ha (C&G stockpile) | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lyleveld pit | | | | | | | 110 ha | 1 | 1 | Low | | 1 | 1 | Low |
| | | Pit expansion | | | | | | | 40 ha | 1 | 1 | Low | | 1 | 1 | Low |
| | Biodiversity (fauna) | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD. | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration | Irreversible | Medium degree | Construction | 1.44 ha | 3 | 1 | Low | Control and prevent | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion. | | | | | 4.5 ha | 3 | 1 | Low | | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | of fauna and flora between areas on an ecosystem scale.<br>These areas are of value as they serve as links to allow the migration of fauna between areas on an ecosystem scale. | | | | 11.30 ha (C&G stockpile) | 3 | 1 | Low | | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lyleveld pit | | Expanding the existing pit | | | | | 110 ha | 3 | 1 | Low | | 3 | 1 | Low |
| | | Pit expansion | | | | | | | 40 ha | 3 | 1 | Low | | 3 | 1 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Operation of Moolmans PCD | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br>These areas are of value as they serve as links to allow the migration of fauna between areas on an ecosystem scale. | Reversible | Low degree | Operation | 1.44 ha | 3 | 1 | Low | Control and prevent | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Operation of the tyre storage area | | | | | 4.5 ha | 3 | 1 | Low | | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Operation of the C&G stockpile | | | | | 11.30 ha (C&G stockpile) | 3 | 1 | Low | | 3 | 1 | Low |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lyleveld pit | | Expanding the existing pit | | | | | 110 ha | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Pit expansion | | Mining activities to enlarge the pit size | | | | | 40 ha | 2 | 3 | Medium | | 2 | 2 | Low |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | The removal of natural vegetation is regarded as a significant impact. However, should rehabilitation to as close as pre-mining conditions be undertaken appropriately and adequately, as well as the control of alien invasive species, a residual impact on vegetation may be prevented. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site.<br>Air pollution from operational activities such as transportation of waste. The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Reversible | Low degree | Decommissioning and closure | 1.44 ha | Not applicable | | | Control | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | 4.5 ha | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | 11.30 ha (C&G stockpile) | Not applicable | | | | Not applicable | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Lyleveld pit | | | | | | | 110 ha | 1 | 1 | Low | | 1 | 1 | Low |
| | | Pit expansion | | | | | | | 40 ha | 1 | 1 | Low | | 1 | 1 | Low |
| 7 | Sites of Archaeological and Cultural Importance | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | No impact on any heritage resources. | Impact already occurred non reversable | Low degree | Construction, Operational, Decommissioning and closure | 1.44 ha | 2 | 2 | Low | Avoid | 2 | 2 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | 4.5 ha | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | 11.30 ha (C&G stockpile) | | | | | | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| 8 | Palaeontological | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | During the Impact Assessment, it was found that the Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup are not known to host fossils. The overlying unconsolidated Tertiary-Quaternary sediments of the Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. It is thus extremely unlikely that fossils will be found in the study area and be affected by the proposed expansion developments. | Not Reversible | Low degree | Construction | 1.44 ha | 1 | 1 | Low | Control | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | 4.5 ha | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | 11.30 ha (C&G stockpile) | | | | | | | |
| | | | Alternative 2 | | | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Pit expansion | No alternatives | Expansion of the pit | Expansion of the pit will cause loss of soils, causing change of land use and impact the land capability. | | | | 40 ha | | | | | | | |
| | | Lyleveld pit | Not applicable | Expanding of the pit | Pans identified in the area will not be impacted upon. However, the pit will be within 500 m of the Gamagara River but outside the 1:100 floodline. The Gamagara river buffer area was calculated to be 160 m5. | Not reversible | Medium degree | | 110 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred) | Construction of Moolmans Workshop and PCD | Five small, interspersed pans (MW1, MW2, MW3, MW4, and MW5) were mapped surrounding the Moolmans maintenance workshop.<br>Pans MW1 and MW2 are located outside of the 500 m regulated zone.<br>Pans MW3, MW4 and MW5 are located within the 500 m regulated zone. | Not reversible | Medium degree | | 6.5 ha | 4 | 2 | Medium | Control and stop | 4 | 2 | Medium |
| | | | PCD alternative 2 | | | | | | | | | | | | | |
| | | Moolmans Workshop haul road | Haul road alternative 1 | Construction of haul road for mining vehicles | Pan MW5 is classed as largely modified due to an existing access road that transverses the pan. | Not reversible | Medium degree | | 5 ha | 3 | 1 | Low | Control and stop | 3 | 1 | Low |
| | | | Haul road alternative 2 | | Pan MW4 is classed as largely natural. | | | | | 4 | 2 | Medium | | 4 | 2 | Medium |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | Tyre expansion area | Alternative 1 (preferred) | Construction of tyre expansion | The Four small, interspersed pans (WT1, WT2, WT3 and WT4) mapped west and south of the Tyre yard is located within the 500 m regulated zone and require water use authorisation. | Not reversible | Medium degree | | 4.5 ha | 3 | 1 | Low | Control and stop | 3 | 1 | Low |
| | | | Alternative 2 | | Four small, interspersed pans (WT1, WT2, WT3 and WT4 were mapped west and south of the Tyre yard. The pans is located outside the 500 m regulated zone. | | | | | 4 | 2 | Medium | | 4 | 2 | Medium |
| | | Lylyveld C & G stockpiles and backfilled area | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | No impacts to any pans identified in the vicinity. Alternative 1 is located within the existing backfilled pit. | | | | 11.30 ha (C&G stockpile) | 2 | 2 | Low | Control | 2 | 2 | Low |
| | | | Alternative 2 | | No impacts to any pans identified in the vicinity. Alternative 2 is located outside of the existing pit and destroying greenfield areas. | | | | 11.51 ha (C&G stockpile) | 2 | 3 | Medium | | 2 | 3 | Medium |
| | | Lylyveld pit | No alternatives | | Pans identified in the area will not be impacted upon. However, the pit will be within 500 m of the Gamagara River 1:100 floodline. | Not Reversible | Medium Degree | | 110 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | Lyleveld C&G stockpile area and backfilled area | Alternative 1 | | No impacts to any pans identified in the vicinity. Alternative 1 is located within the existing backfilled pit. | Not Reversible | Medium Degree | | 11.30 ha (C&G stockpile) | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | | Alternative 2 | | No impacts to any pans identified in the vicinity. Alternative 2 is located outside of the existing pit and destroying greenfield areas. | | | | 11.51 ha (C&G stockpile) | 2 | 3 | Medium | Control | 2 | 3 | Medium |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred) | | Five small, interspersed pans (MW1, MW2, MW3, MW4, and MW5) were mapped surrounding the Moolmans maintenance workshop. | Not Reversible | Medium Degree | | 6.5 ha | 4 | 2 | Medium | Control and stop | 4 | 2 | Medium |
| | | | PCD alternative 2 | | Pans MW1 and MW2 are located outside of the 500 m regulated zone.<br>Pans MW3, MW4 and MW5 are located within the 500 m regulated zone. | | | | | | | | | | | |
| | | Tyre expansion area | Alternative 1 (preferred) | | The Four small, interspersed pans (WT1, WT2, WT3 and WT4) mapped west and south of the Tyre yard is located within the 500 m regulated zone and require water use authorisation. | Not Reversible | Medium Degree | | 4.5 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | | Alternative 2 | | Four small, interspersed pans (WT1, WT2, WT3 and WT4 were mapped west and south of the Tyre yard. The pans is located outside the regulated zone. | | | | | 4 | 2 | Medium | Control and stop | 4 | 2 | Medium |
| | | Lyleveld pit | Not applicable | Decommissioning and closure of the Lyleveld pit | Pans identified in the area will not be impacted upon. However, the pit will be within 500 m of the Gamagara River 1:100 floodline. | Not Reversible | Medium Degree | | 110 ha | 3 | 1 | Low | Control | 3 | 1 | Low |
| | | Lyleveld C&G stockpile area | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | No impacts to any pans identified in the vicinity. Alternative 1 is located within the existing backfilled pit. | Not Reversible | Medium Degree | | 11.30 ha (C&G stockpile) | 3 | 1 | Low | Control | 3 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | Alternative 2 | | No impacts to any pans identified in the vicinity. Alternative 2 is located outside of the existing pit and destroying greenfield areas. | | | | 11.51 ha (C&G stockpile) | | | | | | | |
| | | Moolmans Maintenance Workshop | Alternative 1 (preferred) | Decommissioning and closure of the Moolmans Workshop | Two small, interspersed pans were mapped west of the Moolmans maintenance workshop. | Not Reversible | Medium Degree | | 6.5 ha | 4 | 2 | Medium | Control | 4 | 2 | Medium |
| | | Tyre expansion area | Alternative 1 (preferred) | Four small, interspersed pans were mapped west and south of the Tyre yard. | The Four small, interspersed pans (WT1, WT2, WT3 and WT4) mapped west and south of the Tyre yard is located within the 500 m regulated zone and require water use authorisation. | Not Reversible | Medium Degree | | 4.5 ha | 4 | 2 | Medium | Control and prevent | 4 | 2 | Medium |
| 10 | Air quality | Ore stockpile, and roads | Alternative 1 (preferred) | Windblown dust from waste dumps, haul roads, blasting in the pit and materials handling | Impact on the ambient air quality. | Partially reversible | High degree | Operational | 4000 ha | 3 | 4 | High | Control through mine planning | 3 | 3 | Medium |
| | | | Alternative 2 | | | Partially reversible | High degree | Operational | | 4 | 3 | High | | 3 | 3 | Medium |
| 11 | Noise | Activities associated with the development of the Moolman Maintenance Workshop | Alternative 1 (preferred) | The activities may raise ambient sound levels at the closest NSR. | The activities may raise ambient sound levels at the closest Noise-Sensitive Receptor ("NSR"). | Reversible | Low degree | Construction and operational | Up to 35 dBA | 1 | 1 | Low | None required | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Activities associated with the development of the Tyre Storage Yard (valid for both alternatives) | Alternative 1 (preferred) | The activities may raise ambient sound levels at the closest NSR. | | Reversible | Low degree | Construction and operational | Up to 35 dBA | 1 | 1 | Low | | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Activities associated with the development of the Far South Expansion Project as well as associated infrastructure (valid for all alternatives) | Alternative 1 (preferred) | The activities may raise ambient sound levels at the closest NSR at night. | | Reversible | High degree | Construction and operational | Up to 40 dBA | 5 | 5 | High | Control | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Activities associated with increasing of pit, backfilling activities and construction and operation of stockpile (valid for both alternatives) | Alternative 1 (preferred) | The activities may raise ambient sound levels at the closest NSR. | | Reversible | Low degree | Construction and operational | Up to 35 dBA | 1 | 1 | Low | None required | 1 | 1 | Low |
| | | | Alternative 2 | | | | | | | | | | | | | |
| 12 | Visual | Pit expansion including PB 19 | No alternatives | Site clearing of the project footprint areas associated with the proposed expansion area, including the stockpiles, roads etc. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | Partially reversible | High degree | Construction | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be | 3 | 3 | Medium | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning | 3 | 3 | Medium |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | Not reversible | High degree | | visible to sensitive receptors. | | | | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | | | |
| | | | | Construction of the stockpiles, roads etc.; | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | Partially reversible | High degree | | Impacts are limited to the activity and its immediate surroundings (tens of metres). | 3 | 3 | Medium | To minimise the visual impact from excavations | 3 | 1 | Low |
| | | | | | Topographical alteration as a result of construction activities such as the stockpiles that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region. | Not reversible | | | Impact on local scale/ adjacent sites (km's). Alterations to the topography of the landscape is likely to be visible for significant distances. | 3 | 5 | High | To shape the stockpiles in a more natural manner that blends in with the landscape | 3 | 4 | High |
| | | | | Night time lighting associated with the proposed far south substation and PB 19. | PB 19 remaining, partially altering the skyline. | Partially reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 4 | 2 | Medium | PB 19 remaining there are limited mitigation measures that will reduce the impact significance therefore visual scarring will remain. . . | 4 | 2 | Medium |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | Partially reversible | High degree | Decommissioning and closure | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | 3 | 3 | Medium |
| | | | | Rehabilitation activities. | Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | | | | | | | | | | | |
| | | Proposed C&G Stockpile areas associated with the Lylyveld pit. | | Site clearing of the project footprint areas associated with the proposed stockpiles and proposed Lylyveld opencast pit. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | Partially reversible | High degree | Construction | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning | 3 | 2 | Medium |
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | Not reversible | High degree | | | 3 | 4 | High | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | 3 | 3 | Medium |
| | | | | Construction of the stockpiles | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | Partially reversible | High degree | | Impacts are limited to the activity and its immediate surroundings (tens of metres) | 3 | 2 | Medium | To minimise the visual impact from excavations | 3 | 1 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | | | Topographical alteration as a result of construction activities such as the stockpiles that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region. | Not reversible | High degree | | Impact on local scale/ adjacent sites. Alterations to the topography of the landscape is likely to be visible for significant distances. | 3 | 5 | High | To shape the stockpiles in a more natural manner that blends in with the landscape | 3 | 4 | High |
| | | | | Dumping of waste material at the stockpiles;<br>Dust generation especially on a windy day from dumping of waste material. | Continual dumping of material and increasing heights of the stockpiles during operational activities. | Not reversible | High degree | Operation | Impact on local scale/ adjacent sites (km's). stockpiles of significant vertical heights are likely to be visible over significant distances. | 3 | 3 | Medium | To limit visual impacts as a result of dumping of material at the stockpiles. | 3 | 2 | Medium |
| | | | | | Mine vehicles driving on haul roads and dumping of waste material on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors. | Reversible | Medium degree | | | 3 | 3 | Medium | To limit impacts on the visual environment from haziness caused by dust | 2 | 1 | Low |
| | | Proposed C&G Stockpile areas associated with the Lllyveld pit. | Relevant to both alternatives | Night time lighting associated with the Lylyveld opencast pit | Night time lighting due to 24 hour operations of the operations, substation and PB Pits 19 potentially impacting on receptors. | Reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 2 | Medium | To limit visual impacts from night time lighting | 2 | 1 | Low |
| | | | | Backfilling of the Lylyveld opencast pit | Backfilling into the Lylyveld opencast pit, altering the skyline, may be a net positive impact. | Partially reversible | Medium degree | Decommissioning and closure | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 4 | 2 | Medium | Backfilling of the Lylyveld open cast pit may be a low positive impact, if it is rehabilitated well, possibly resulting in no visual scarring | 3 | 4 | High |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | Partially reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To limit visual impacts as a result of mine surface infrastructure decommissioning | 3 | 2 | Medium |
| | | | | Rehabilitation activities. | Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | Partially reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | 3 | 3 | Medium |
| | | Tyre storage yards | | Site clearing of the project footprint areas associated with the tyre storage yards. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | Partially reversible | High degree | Construction | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 3 | Medium | To keep development footprint area as small as possible in order to prevent unnecessary | 2 | 2 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | | Construction of the tyre storage yards | Placement of gravel within the tyre storage yard and the fence on the periphery | Partially reversible | Medium degree | | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 3 | Medium | loss of vegetation, control through planning | 2 | 2 | Low |
| | | | | Placement of used tyres and potentially increasing the height of the tyre piles | Continual placement of used tyres and potentially increasing the height of the tyre piles | Reversible | Medium degree | Operation | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 3 | Medium | To limit visual impacts | 2 | 2 | Low |
| | | | | Dust generation from the gravel | Mine vehicles dumping tyres on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors. | | | | | 3 | 3 | Medium | To limit impacts on the visual environment from haziness caused by dust | 2 | 2 | Low |
| | | | | Night time lighting associated with the proposed tyre storage yard | Night time lighting due to 24 hour operations of tyre storage yard | Reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 2 | Medium | To limit visual impacts from night time lighting | 2 | 1 | Low |
| | | | | Demolition of tyre storage area | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors | Potentially reversible | Medium degree | Decommissioning and closure | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To limit visual impacts | 2 | 2 | Low |
| | | | | Rehabilitation activities. | Potential ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | Potentially reversible | Medium degree | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | 2 | 2 | Low |
| | | Moolmans Workshop facilities and associated PCDs | | Site clearing of the project footprint areas associated with the proposed expansion area, including the PCDs and the Moolmans Workshop facilities | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | Partially reversible | High degree | Construction | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 3 | Medium | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning. | 2 | 2 | Low |
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | Not reversible | High degree | | | 3 | 3 | Medium | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | 2 | 2 | Low |
| | | | | Construction of the Moolmans Workshop facilities and PCDs | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | Reversible | Medium degree | | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 3 | Medium | To minimise the visual impact from excavations | 2 | 2 | Low |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Reversibility | Irreplaceable loss | Phase | Size and scale of disturbance | Significance pre-mitigation | | | Mitigation Type | Significance post-mitigation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Probability | Magnitude | Significance | | Probability | Magnitude | Significance |
| | | | | Operation of the Moolmans Workshop Facility | Continual movement of mine workers in the area | | | Operation | Effect limited to the site (metres) | 3 | 2 | Medium | To limit visual impacts as a result of dumping of material at the stockpiles | 2 | 2 | Low |
| | | Moolmans Workshop facilities and associated PCDs | | Night time lighting associated with the proposed Moolmans Workshop Facility | Night time lighting due to 24 hour operations of the HME Moolmans Workshop Facility potentially impacting on receptors. | | | | Effect limited to the activity and its immediate surroundings. (tens of metres) | 3 | 2 | Medium | To limit visual impacts from night time lighting | 2 | 1 | Low |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | Potentially reversible | Medium degree | Decommissioning | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To limit visual impacts as a result of mine surface infrastructure decommissioning | 3 | 2 | Medium |
| | | | | Rehabilitation activities. | Potential ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | | | | Impacts are extended beyond the site boundaries (hundreds of meters) to include areas from where the impact is expected to be visible to sensitive receptors. | 3 | 3 | Medium | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | 3 | 3 | Medium |
| 13 | Socio-economic | Moolmans PCD | Alternative 1 (preferred) | Construction, and operation, of the Sishen Expansion project. | Jobs will be retained, and additional jobs created providing income and, therefore, having a further positive impact on the regional socio-economy aspects of the area, along with other benefits arising from the Social and Labour Plan. | Reversible | Low degree | Construction, and operational | Local and regional | Positive impact | | | Control | Positive impact | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | | | | | | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | | | | | | | | | | | | |
| | | | Alternative 2 | | | | | | | | | | | | | |

*Table 15: Identified cumulative impacts*

| Environmental component (Aspects affected) | Potential Impact description |
|---|---|
| Biodiversity | Animal Impact assessment:<br>Cumulative impacts arise from the combined presence of several similar developments within an area which affect animal species. There are other developments that also represents a source of disturbance and habitat loss, which when combined with the proposed development would result in some cumulative impact. However, when taken in context of the broader landscape, the cumulative impacts are not likely to be highly significant given the animal species known to occur in the broader area.<br>Terrestrial Biodiversity assessment:<br>Cumulative impacts arise from the combined presence of several similar developments within an area which affect ecological processes operating at broader scales or which each have a small impact which becomes significant when combined. There are other mining activities in the area which represents a source of disturbance and habitat loss, which when combined with the current proposed mine expansion would result in some cumulative impact. However, when taken in context of the broader landscape, the cumulative impacts are not likely to be highly significant given the extensive intact nature of the landscape as a whole. |
| Air quality | The significance ranking for the proposed project is MEDIUM, but the significance ranking for the current Sishen operations is HIGH and the cumulative impact is rated to have a HIGH significance. |
| Sensitive landscapes (wetlands) | Aquatic Biodiversity assessment:<br>Cumulative impacts arise from the combined presence of several similar developments within an area which affect ecological processes operating at broader scales or which each have a small impact which becomes significant when combined. There are other mining activities in the area which represents a source of disturbance and habitat loss, which when combined with the current proposed mine expansion would result in some cumulative impact. However, when taken in context of the broader landscape, the cumulative impacts are not likely to be highly significant given the extensive intact nature of the landscape as a whole. |
| Visual | Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed expansion activities are of low significance, due to existing mining activities within the area (SIOM, Mamatwan, Tshipi Mine, Kumba Iron Ore Mine) as well as the area being within the Gamagara Corridor which is the mining belt of the John Taolo Gaetsewe and Siyanda districts. Since the proposed expansion area is situated within the mining belt and on already disturbed land, the cumulative impact thereof is not considered significant, as the sparse receptors within the area are accustomed to the existing mining activities. These receptors include mine workers, farmers, contract workers and occasional tourists passing through the area.<br>Cumulative visual impacts resulting from the night time lighting associated with the existing mines in the area as well as from the towns (Kuruman, Hotazel, and Kathu) are considered of low significance due to the distance between these areas as well as the screening provided by the bushveld vegetation. |
| Geohydrological | The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a GQM index of 6 for the study area, indicating that medium level groundwater protection is required to adhere to DWS's water quality objectives. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, during short- and long-term. DWS's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that if any potential risk exists, measures must be taken to limit the risk to the environment, which in this case is the protection of the underlying aquifer. |

| Environmental component (Aspects affected) | Potential Impact description |
|---|---|
| Socio-Economic | Jobs will be retained, providing income and, therefore, having a further impact on the regional socio-economy aspects of the area. |

## 6.7 Methodology used in determining and ranking potential environmental impacts and risks

### 6.7.1 Methodology to be applied during the EIA and EMPr phase

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk.

Impact assessments should be conducted based on a methodology that includes the following:

- Clear processes for impact identification, predication and evaluation.
- Specification of the impact identification techniques.
- Criteria to evaluate the significance of impacts.
- Design of mitigation measures to lessen impacts.
- Definition of the different types of impacts (indirect, direct or cumulative).
- Specification of uncertainties.

After all impacts have been identified, the nature and scale of each impact can be predicted. The impact prediction will take into account physical, biological, socio-economic and cultural information and will then estimate the likely parameters and characteristics of the impacts. The impact prediction will aim to provide a basis from which the significance of each impact can be determined, and appropriate mitigation measures can be developed. The risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor). Refer to Figure 23 below for a model representing the above principle (as contained in the DWA's Best Practice Guideline: G4 – Impact Prediction).

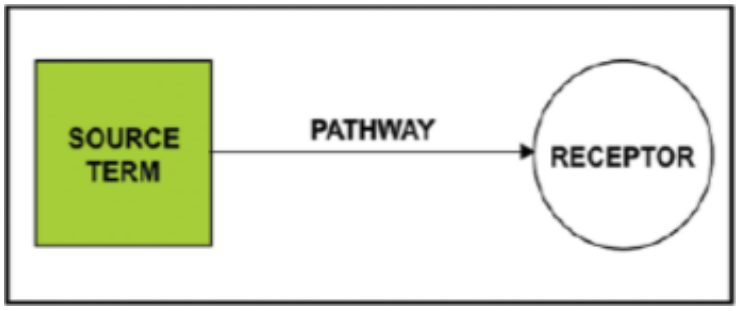


*Figure 23: Impact prediction model*

*Table 16 and Table 18 below indicate the methodology to be used in order to assess the Probability and Magnitude of the impact, respectively, and provides the Risk Matrix that will be used to plot the Probability against the Magnitude in order to determine the Severity of the impact in Table 17.*

*Table 16: Determination of Probability of impact*

| Score | Frequency of Aspect / Unwanted Event | Availability of Pathway from the source to the receptor | Availability of Receptor |
|---|---|---|---|
| 1 | Never known to have happened, but may happen | A pathway to allow for the impact to occur is never available | The receptor is never available |
| 2 | Known to happen in industry | A pathway to allow for the impact to occur is almost never available | The receptor is almost never available |
| 3 | < once a year | A pathway to allow for the impact to occur is sometimes available | The receptor is sometimes available |
| 4 | Once per year to up to once per month | A pathway to allow for the impact to occur is almost always available | The receptor is almost always available |
| 5 | Once a month - Continuous | A pathway to allow for the impact to occur is always available | The receptor is always available |

*Step 1: Determine the PROBABILITY of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor.*

*Table 17: Determination of Severity of impact*

| Environmental Impact Rating / Priority | | | | | |
|---|---|---|---|---|---|
| | MAGNITUDE | | | | |
| **Probability** | **1 Minor** | **2 Low** | **3 Medium** | **4 High** | **5 Major** |
| **5 Almost Certain** | Low | Medium | High | High | High |
| **4 Likely** | Low | Medium | High | High | High |
| **3 Possible** | Low | Medium | Medium | High | High |
| **2 Unlikely** | Low | Low | Medium | Medium | High |
| **1 Rare** | Low | Low | Low | Medium | Medium |

*Step 3: Determine the SEVERITY of the impact by plotting the averages that were obtained above for Probability and Magnitude.*

*Table 18: Determination of Magnitude of impact*

| Score | Source | | | | | Receptor |
|---|---|---|---|---|---|---|
| | Duration of impact | Extent | Volume / Quantity / Intensity | Toxicity / Destruction Effect | Reversibility | Sensitivity of environmental component |
| 1 | Lasting days to a month | Effect limited to the site. (metres); | Very small quantities / volumes / intensity (e.g. < 50 ℓ or < 1 ha) | Non-toxic (e.g. water) / Very low potential to create damage or destruction to the environment | Bio-physical and/or social functions and/or processes will remain unaltered. | Current environmental component(s) are largely disturbed from the natural state. |
| 2 | Lasting 1 month to 1 year | Effect limited to the activity and its immediate surroundings. (tens of metres) | Small quantities / volumes / intensity (e.g. 50 ℓ to 210 ℓ or 1 ha to 5 ha) | Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment | Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible | Receptor of low significance / sensitivity |
| 3 | Lasting 1 – 5 years | Impacts on extended area beyond site boundary (hundreds of metres) | Moderate quantities / volumes / intensity (e.g. > 210 ℓ < 5000 ℓ or 5 – 8 ha) | Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment | Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible | Current environmental component(s) are moderately disturbed from the natural state. |
| 4 | Lasting 5 years to Life of Organisation | Impact on local scale / adjacent sites (km) | Very large quantities / volumes / intensity (e.g. 5000 ℓ – 10 000 ℓ or 8 ha– 12 ha) | Toxic (e.g. diesel & Sodium Hydroxide) | Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible | No environmentally sensitive components. |
| 5 | Beyond life of Organisation / Permanent impacts | Extends widely (nationally or globally) | Very large quantities / volumes / intensity (e.g. > 10 000 ℓ or > 12 ha) | Highly toxic (e.g. arsenic or TCE) | Bio-physical and/or social functions and/or processes might be severely/substantially altered or enhanced / Irreversible | Current environmental component(s) are a mix of disturbed and undisturbed areas. |

*<u>Step 2</u>: Determine the MAGNITUDE of the impact by calculating the average of the factors above*

## 6.8 Positive and negatives that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and community affected

The positive and negative implication of the Sishen Expansion Project and the alternative identified have been provided below in Table 19 and assessed in terms of the following four categories:

- Environmental.
- Technical/Engineering.
- Economical.
- Social.

*Table 19: Advantage and disadvantages of the proposed activities and identified alternatives*

| Alternative | Advantages | Disadvantages |
|---|---|---|
| **Location Alternative for the proposed Moolmans pollution control dam** | | |
| Location Alternative 1 | **Environmental:** Alternative 1 is situated approximately 350 m from the closest pan that was licensed under a previous project.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. |
| Location Alternative 2 | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. | **Environmental:** Alternative 2 is situated approximately 200 m from the closest pan.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. |
| **Location Alternative for the proposed Moolmans haul road** | | |
| Location Alternative 1 | **Environmental:** Alternative 1 will be rerouted to avoid the already affected pan licensed in a previous project. Pan MW5 is classed as largely modified.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** Additional costs to reroute the existing road to outside of the pan.<br>**Social:** None. |
| Location Alternative 2 | **Environmental:** Pan MW4 is classed as largely natural and will not be impacted upon.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. | **Environmental:** Peripheral impacts to the pan.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. |
| **Location Alternative for the proposed tyre expansion area** | | |
| Location Alternative 1 | **Environmental:** Alternative 1 is situated approximately 580 m from the nearest pan. | **Environmental:** None.<br>**Technical/Engineer:** None. |

| Alternative | Advantages | Disadvantages |
|---|---|---|
| | **Technical/Engineer:** Alternative 1 is closer to the access road.<br>**Economical:** Alternative 1 will be less distance to travel to access the tyre storage area.<br>**Social:** None. | **Economical:** None.<br>**Social:** None. |
| Location Alternative 2 | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** Alternative 2 will require construction of a short section of access road.<br>**Social:** None. | **Environmental:** Alternative 2 is situated closer to the pans as alternative 1 (300 m)<br>**Technical/Engineer:** Alternative 2 is further from the access road.<br>**Economical:** Alternative 2 will require construction of an access road.<br>**Social:** None. |
| **Location Alternative for the proposed Lylyveld C&G stockpile area with backfilling of the pit** | | |
| Location Alternative 1 | **Environmental:** No new greenfield areas will be disturbed as the pit is disturbed. Less pollution will occur if the product is stockpiled in the backfilled pit.<br>**Technical/Engineer:** The Lylyveld pit will be completely backfilled to the original elevation and the stockpile will be on the backfilled area within the pit.<br>**Economical:** Backfilling of the Lylyveld pit will require less haulage distance as opposed to transporting to Lylyveld Waste Rock dump.<br>**Social:** Less visual impact to surrounding residents as disturbed areas are used for the stockpile. | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** None. |
| Location Alternative 2 | **Environmental:** None.<br>**Technical/Engineer:** None.<br>**Economical:** Alternative 2 will require longer hauling distances thus making it more expensive.<br>**Social:** None. | **Environmental:** A greenfield area will have to be disturbed for alternative 2 as the footprint is within the pit and as well undisturbed areas.<br>**Technical/Engineer:** None.<br>**Economical:** None.<br>**Social:** More visual impact as the C&G stockpile will be within and outside of the Lylyveld pit. |

From review of the table above, alternative 1 for the proposed Moolmans pollution control dam and haul road, tyre expansion area and Lyleveld C&G stockpile are the preferred alternatives in terms of project layout.

## 6.9 Possible mitigation measures that could be applied and the level of risk

The level of risks identified has been included under Section 6.6.1 of Part A and impact management measures under Section 1.4 of Part B. The table below provides for a summary of the issues and concerns as raised by affected parties and an assessment of the mitigations or site layout alternatives

available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered.

*Table 20: Summary of issues and concerns raised by I&APs*

| Concerns as raised by affected parties | Mitigation measures or site alternative |
|---|---|
| No concerns have been raised thus far with regards to project or layout aspects, for which additional alternatives considerations (to those already identified) are required. Refer to Table 7 for comments received as part of the Scoping Phase public participation process. For concerns identified as part of the EIAR/EMPr phase, such will be included in this table at finalisation of this report. | |

## 6.10 Final site layout plan

The outcome of the final site selection is discussed in Section 11 of Part A and the final layout plan included in Section 12 of Part A. Refer to the Figure 24 below for the preferred alternative 1 layout.

# 7 Full description of the process undertaken to identify, assess and rank the impacts and risks

All impacts and risks as identified are contained within Section 6.6.1 of Part A. As further provided is an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures. The methodology applied in assessing and ranking the impacts and risks on the preferred site is described in Section 6.7.1 of Part A.

# 8 Assessment of each identified potentially significant impact and risk

Refer to the full risk assessment table provided in Section 6.6.1 of Part A above.

# 9 Summary of specialist reports

| Specialist study | Recommendations of specialists | Reference to applicable section in report where specialist recommendation is included |
|---|---|---|
| Terrestrial Animal Species Impact Assessment | All recommendations and mitigation / management measures contained in specialist reports contained in Annexure E have been included in Section 1.4 in Part B of this report. | Section 1.4 in Part B |
| Aquatic Biodiversity Impact Assessment | | |
| Terrestrial Biodiversity Impact Assessment | | |
| Terrestrial Plant Species Compliance Statement | | |

| Specialist study | Recommendations of specialists | Reference to applicable section in report where specialist recommendation is included |
|---|---|---|
| Stormwater management plan | | |
| Geohydrological Study | | |
| Air Quality Impact Assessment | | |
| Phase 1 heritage assessment | | |
| Visual Impact Assessment | | |
| Noise assessment | | |
| Desktop Palaeontological study | | |

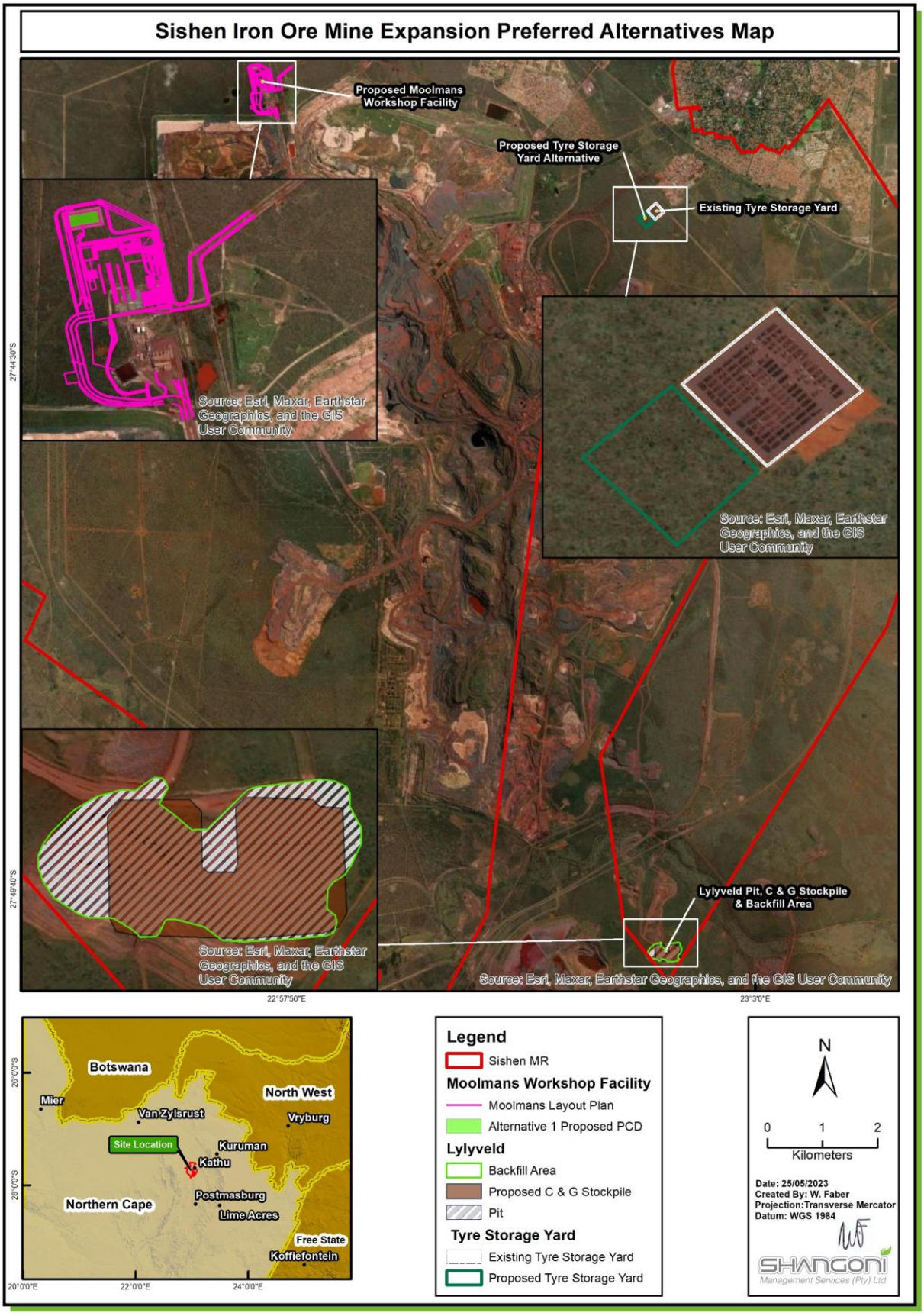


*Figure 24: Final (preferred) layout*

# 10 Environmental impact statement

## 10.1 Summary of the key findings of the environmental impact assessment

A summary of the high significant impacts (pre-mitigation) include:

- The impact to geology and nature of the topography as stockpiled material will be higher than the surrounding areas,
- Clearing of soil for the tyre expansion alternative 2,
- Impact on the ambient air quality from windblown dust generated by the stockpiles, haul roads and material handling,
- Noise generated from Far South activities (PB 19),
- Visual impacts from stockpiles and roads created by topographical alteration that will be silhouetted in the skyline, as well as the alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure created from C&G stockpiles and areas associated with the Lyleveld pit.

Mitigation and management measures for the predicted impacts are included in Part B of this EIAR/EMPr and need to be implemented by the applicant. The implementation of the mitigation measures will result in the minimisation of the significance of the potential impacts (post-mitigation). All high significance impacts pre-mitigation will be lowered to medium and low significance impacts post-mitigation, except for visual impacts because of construction activities of stockpiles (to be located on the backfilled Lyleveld opencast pit) and roads that will cause topographical alteration, backfilling into the Lyleveld opencast pit that will alter the skyline but may be a net positive impact.

## 10.2 Final site map

Refer to

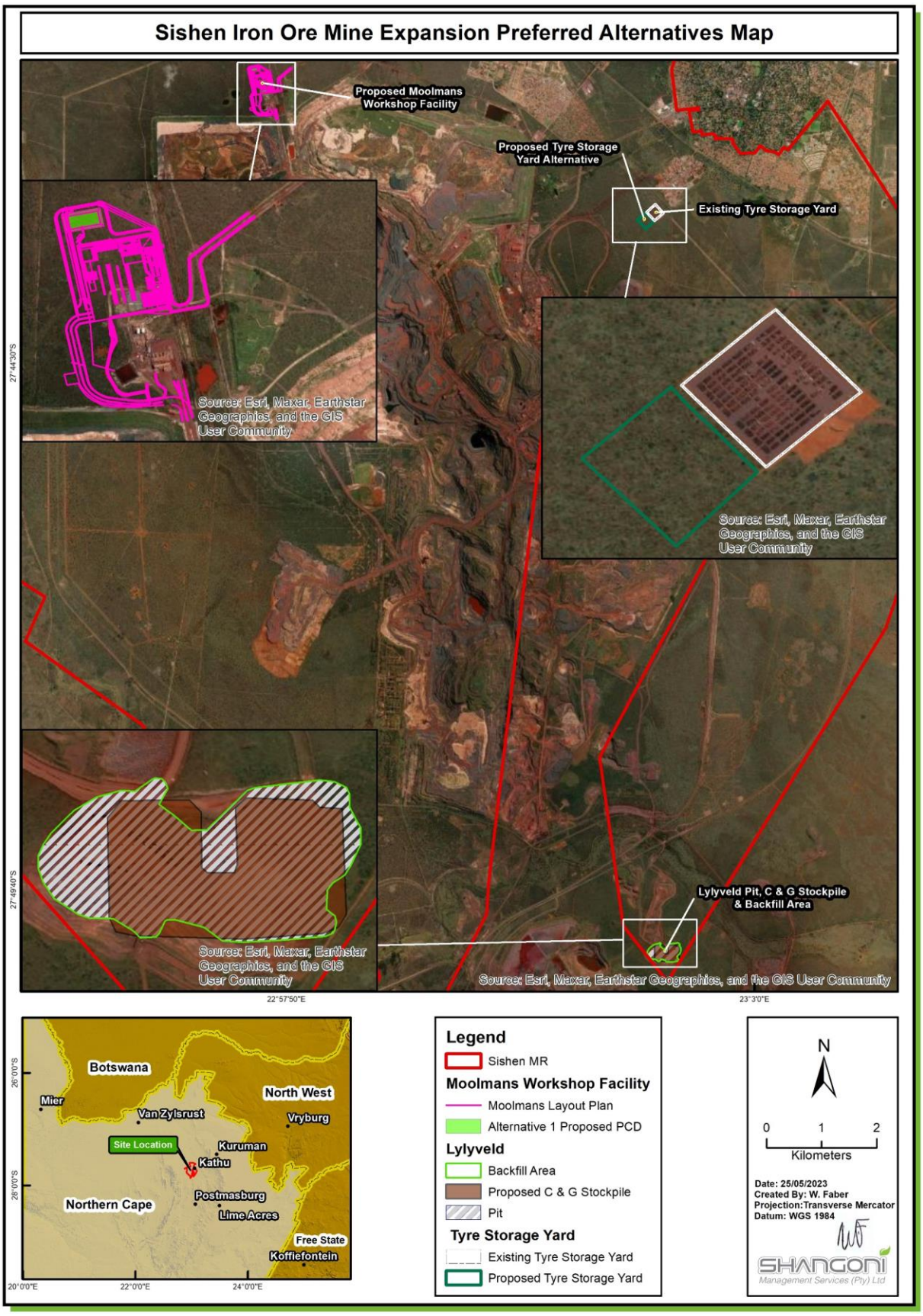

Figure 24 that illustrates the final site map of the project.

# 11 Proposed impact management outcomes for inclusion into the EMPr

Based on the assessment and where applicable the recommendations from specialist reports, Table 21 below summarises the impact management outcomes for the proposed project for inclusion in the EMPr as well as for inclusion as conditions of authorisation.

*Table 21: Impact management outcomes*

| Aspect affected | Impact management outcome | Standard to be achieved |
|---|---|---|
| Topography, soils, land use and land capability | Ensure minimum change in topography.<br>Preserve sufficient soil volumes to enable pre-mining land capability post-rehabilitation. | Principles in the MPRDA, 2002, NEMA, 1998, NEM:WA, 2008, Regulations there under and amendments thereto.<br>National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GNR.331 of 2014), thereunder.<br>Rehabilitation, decommissioning- and closure plan and closure objectives. |
| Biodiversity | Permits are required for destruction of protected flora and fauna.<br>Limit development footprint according to the designs. Actively manage edge effects on surrounding natural habitat.<br>Limit edge effects and alien plant proliferation.<br>Implement dust suppression protocols where possible.<br>Prevent any further disturbance to habitat considered sensitive or in a good ecological condition and ensure effective rehabilitation of disturbed areas. Develop an effective and ecologically suitable rehabilitation plan. | NEM:BA (2004) and the regulations thereunder.<br>Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.<br>Environmental Conservation Act, 1989 (Act No 73 of 1989).<br>National Forests Act, 1998 (Act No 84 of 1998).<br>Northern Cape Nature Conservation Act, No. 9 of 2009.<br>National Veld and Forest Fire Act, 1998 (Act No 101 of 1998).<br>National Environmental Management: Protected Areas Act (NEM:PAA) (Act No 57 of 2003). |
| Surface water | To prevent erosion and siltation of watercourses.<br>To prevent surface water quality deterioration. | National Water Act, 1998 and associated Regulations. |
| Groundwater | To minimise the extent of disturbance of the aquifer.<br>To limit groundwater quality deterioration. | |
| Air quality | Prevent the deterioration of air quality. | National Environmental Management: Air Quality Act (Act No 39 of 2004); Regulations there under and amendments thereto.<br>GG 36974, R827, National Dust Control Regulations, 1 November 2013. |
| Noise | Limit the generation of noise through the various activities to prevent the causing of any possible disturbance or discomfort of fauna or communities as a result. | Relevant sections of the National Environmental Management: Air Quality Act (Act No 39 of 2004); Regulations there under and amendments thereto.<br>SABS Code of Practice 0103 of 2008: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.<br>SABS Code of Practice 0328 of 2008: Environmental Noise Impact Assessments. |
| Sites of Archaeological and Cultural Importance | Conserve heritage resources. | National Heritage Resources Act (Act No. 25 of 1999), and amendments thereto. |
| Sensitive landscapes (wetlands) | Minimise the impact on sensitive landscapes. | National Water Act, 1998 and associated Regulations. |
| Visual | To limit visual impacts. | National Environmental Management Act (NEMA) (Act 107 of 1998).<br>Advertising on Roads and Ribbons Act (Act 21 of 1940). |
| Socio-economic | To maximise economic opportunities for local employment and development. | Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002).<br>Social and Labour Plan. |

# 12 Final proposed alternatives

Refer to Section 6.2 of Part A for the alternatives considered. Alternative 1 for the Moolmans PCD and proposed haul road 1 is the preferred alternative in terms of sensitivities and project layout. Alternative 1 is the preferred alternative for the tyre storage expansion area due to Camel thorn trees and fire hazards from nearby home steads. Alternative 1 for the Lylyveld pit C&G stockpile is the preferred alternative as it is situated within the existing pit that will be backfilled and no new areas will be disturbed.

# 13 Description of any assumptions, uncertainties, and gaps in knowledge

In terms of the EIA Regulations GN R982 Appendix 1(3)(o), the Environmental Impact Assessment Practitioner ("EAP") must provide a description of any assumptions, uncertainties, and gaps in knowledge upon which the impact assessment has been based. Table 22 below provides the assumptions and limitations applicable to the various specialist assessments.

*Table 22: Specialist report assumption, uncertainties, and gaps in knowledge*

| Specialist study | Assumptions and limitations |
|---|---|
| Terrestrial Animal Species Impact Assessment | The presence of fauna must be evaluated based on the literature and available databases but in many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many areas have not been well sampled with the result that the species lists derived for the area do not always adequately reflect the actual fauna and flora present at the site. This is acknowledged as a limitation of the study, however it is substantially reduced through extracting the species lists for a substantially larger area than the site and through the inclusion of information from previous experience in the wider area. The assessment was undertaken using sampling methods appropriate to the protocols, terms of reference and methodologies described above. The timing of the survey is therefore regarded as optimal in terms of accurately assessing the fauna of the site. The overall condition of the vegetation can still be determined with a high degree of confidence. An accurate idea of the priority conservation areas, animals and botanical species was gained, due to the use of a combined habitat and species-based approach, and confidence in the accuracy of the findings is high. The overall confidence in the completeness and accuracy of the animal species findings at this point in time is considered to be good. A follow-up survey is not considered essential for decision-making.<br><br>The site visit and sampling are not representative of all four seasons and was conducted before the rain season. Migratory bird species that inhabit this area in the summer had not yet returned from their migrations and could also have been overlooked. Faunal diversity is only based on visual sightings and/or evidence on-site and no long-term monitoring was conducted. |
| Aquatic Biodiversity Impact Assessment | The ground-truthing, site survey and delineation of the freshwater resource assessment thereof are confined to a site visit undertaken from 12 to 15 September 2022, as identified within the EIA application. All freshwater resources identified within the investigation area were delineated in fulfilment of Regulation GN509 of the National Water Act, 1998 (Act 36 of 1998) using desktop methods described above, including the use of topographic maps, historical and current digital satellite imagery and aerial photographs and were ground-truthed.<br><br>All areas surrounding the development have undergone significant changes (such as mining and associated activities) which have altered the geomorphic characteristics, hydrological regime and vegetation composition. The freshwater resource delineations as presented in this report are regarded as the best based on the site conditions present, as observed during the site assessment. The results obtained are, however, considered sufficiently accurate to allow planning and decision making to take place. |

| Specialist study | Assumptions and limitations |
|---|---|
| | Freshwater resources and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater resource boundaries may occur. However, if the best practice and latest methods are followed, all assessors should get largely similar results. With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the delineations as provided in this report are deemed appropriately accurate to guide any future development plans. |
| Terrestrial Biodiversity Impact Assessment | The presence of fauna must be evaluated based on the literature and available databases but in many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. The assessment was undertaken using sampling methods appropriate to the protocols, terms of reference and methodologies described above in an optimal season. The timing of the survey is therefore regarded as optimal in terms of accurately assessing the terrestrial biodiversity, aquatic biodiversity, plant species and animal species of the site. The overall condition of the ecology and biodiversity can still be determined with a high degree of confidence. An accurate idea of the priority conservation and biodiversity areas was gained, due to the use of a combined habitat and species-based approach, and confidence in the accuracy of the findings is high. The overall confidence in the completeness and accuracy of the terrestrial biodiversity findings at this point in time is considered to be good. A follow-up survey is not considered essential for decision-making. |
| Terrestrial Plant Species Compliance Statement | The site visit was carried out on 12 to 15 September 2022. The timing of the survey is therefore regarded as optimal in terms of accurately assessing the flora of the site. The overall confidence in the completeness and accuracy of the botanical findings at this point in time is considered to be good. A follow-up survey is not considered essential for decision-making. |
| Stormwater management plan | • Whilst every endeavour has been made by Shangoni to ensure that information provided is correct and relevant, this technical report is, of necessity, based on information that could reasonably have been sourced within the time period allocated to the assessment, and is, furthermore, of necessity, dependent on information provided by management and/or its representatives during the course of the project.<br>• It is assumed that the Client provided all information to Shangoni that is relevant to the scope of work included in this technical report and that no important information has been withheld.<br>• The relevant information received from the Client during the course of this project will be deemed true and correct. If such information reflected in any documentation relevant to this project is discovered to be misleading, Shangoni does not take any responsibility for the implications of such misrepresentations made by the Client.<br>• Shangoni is under no obligation to the Client and others to conduct work not specified in the scope of work as agreed in the relevant proposal.<br>• Storm water control recommendations are based on industry experience and best practice. Final designs for construction should be authorised by an approved engineer.<br>• Contour and elevation data as provided during the analysis are assumed to be accurate and representative of the site and catchment areas.<br>• Upstream catchment activities are interpreted according to common practices and no detailed insight is available on possible storm water measures beyond the site. The assessment does not guarantee the integrity of downstream infrastructure in the event of release or discharge from site.<br>• It was assumed that the preferred alternatives (i.e., alternative 1) for the Moolmans pollution control dam ("PCD") and haul roads, tyre storage expansion area and Lyleveld C&G stockpiles are the recommended go-forward options to be constructed. The SWMP and associated mitigation measures where therefore specifically designed for the preferred alternatives.<br>• The measures proposed as part of the storm water management section of the report do not impose preference as this is an operational document to assist in the complete management of clean and affected surface water in the vicinity of the operation.<br>• The measures proposed in the storm water management plan section of the report do not specifically cover considerations relevant to storm water management for the purpose of safety, like mine flooding and loss of life; the primary focus being environmental management and the identification of potential environmental concerns. |
| Geohydrological Study | It is important to note a few assumptions and limitations applicable to the numerical modelling exercise:<br>• The numerical model is a very simplified representation or simulation of the actual situation.<br>• Measured aquifer parameters are used to calibrate the numerical model and the level of confidence of model calculations is only as good as the information (accuracy, distribution, frequency etc.) on which it is based and the conceptual understanding of the geohydrology.<br>• Model calibration was done in steady state. |

| Specialist study | Assumptions and limitations |
|---|---|
| | • The Model was simulated for the upper shallow aquifer only (saturated, horizontal confined aquifer). |
| Air Quality Impact Assessment | Several assumptions had to be made in the study. These, along with other limitations are listed below and should be noted when interpreting the outcomes of the study:<br>• The quantification of sources of emission was restricted to additional emissions that would be generated by the proposed Project.<br>• Project information required to calculate emissions for operations were provided by Shangoni. Where necessary, assumptions were made based on the specialist's experience. These are stated in more detail in the emissions inventory section.<br>• Dispersion modelling was done for two scenarios (2027 and 2029). These were chosen based on the maximum throughput of ore and waste removed from the open pit areas. The dispersion modelling focused on alternative 1 for both 2027 and 2029. Alternative 2 comprised alternative locations for the ore stockpile, the road network. Alternative 2 was only modelled for PM10 for the 2027 scenario. As the emissions for alternative 2 only differ by 1 %, it was not necessary to model alternative 2 for both scenarios. |
| Visual Impact Assessment | • No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005);<br>• Distance and terrain plays a critical role when assessing visual impacts of an area. Due to the relatively flat terrain of the Sishen Expansion Project Area and height of the proposed structures, it was deemed necessary to identify all potential sensitive receptors within a 5 km radius, on a desktop-level, which would then be verified during the field assessment. The 5 km radius can be considered the visual assessment zone. It should be noted that the visibility of an object decreases exponentially the further away the observer is from the source of impact. During the field assessment it was established that the bushveld vegetation limits the view of the observer to the immediate surroundings, not allowing one to see across the vistas. Consequently, it was deemed unnecessary to visit all potentially sensitive receptors within the visual assessment zone, thus focus was placed on visiting sensitive receptors within a 2 km radius. Several sensitive receptors situated further than 3 km were however visited to confirm that the proposed expansion activities are not visible from these locations;<br>• With the Sishen Expansion Project located within the SIOM, the likelihood of distinguishing the proposed expansion activities from existing mine dumps and infrastructure is low. Furthermore, with the rapid increase in the footprint of the mine dumps and opencast pits the DEM does not account for all the mine features, and with the viewshed analysis not taking into account vegetation of the area, it was deemed unnecessary to undertake a viewshed analysis, as the field assessment provided more accurate results;<br>• Due to a lack of visual specialist guidelines within the Northern Cape Province, the "Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process" (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning, was used;<br>• All information relating to the proposed project description as referred to in this report is assumed to be the latest available information. Additionally, best practice guidelines were taken into consideration and utilising the maximum expected heights of the infrastructure and the placement thereof in viewshed calculations as a precautionary approach; and<br>• Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable, as outlined in the diagram below (The Landscape Institute and Institute of Environmental Management and Assessment (LI IEMA, 2002). |
| Noise assessment | Limitations - Acoustical Measurements<br>Limitations due to environmental acoustical measurements include the following:<br>• Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced a measurement using the reading result at the end of the measurement. Therefore, trying to define ambient sound levels using the result of one 10-minute measurement can be inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher |

| Specialist study | Assumptions and limitations |
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| | the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement. When singular measurements are used, a precautious stance must be adopted (this report use long-term measurements as well as short-term measurements collected by dBAcoustics).<br>• Ambient sound levels are dependent not only on time of day and meteorological conditions but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise. Many faunal species are more active during warmer periods than colder periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals .<br>• It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice, this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including:<br>  ○ the distance to closest trees, number and type of trees as well as the height of trees;<br>  ○ distance to roads, construction material of the road, the traffic volumes on that road as well as the average speeds on this road;<br>  ○ available habitat and food for birds and other animals;<br>  ○ distance to residential dwelling, type of equipment used at dwelling (compressors, air-con);<br>  ○ general maintenance condition of house (especially during windy conditions); and<br>  ○ number and type of animals kept in the vicinity of the measurement locations (typical land use taking place around the dwelling).<br>• Measurements over wind speeds of 3 - 5 m/s could provide data influenced by wind-induced noises;<br>• Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity, which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during the dawn chorus of bird songs). This generally is still considered naturally quiet and accepted as features of the natural baseline, and in various cases sought after and pleasing. Using this data to define the ambient sound level will result in a higher rating level, and data collected close to such measurement locations will not be considered;<br>• Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as LAMin, LAeq, LAMax, LA10, LA90 and spectral analysis forms part of the many variables that can be considered. However, South African legislation requires consideration of the impulse-weighted LAeq setting that will be considered when measuring ambient sound levels;<br>• Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptor's dwelling, or measuring environmental ambient baseline contributors of significance (faunal, roads traffic, railway traffic movement etc.);<br>• The measurement of ambient sound levels in nature, away from roads and residential dwellings and significant vegetation normally indicate a very quiet environment, typical of a rural noise district. This assessment however focusses on defining the ambient sound levels at one or more residential dwellings over a period of at least two nights. This is because the ambient sound levels determined in this manner is more representative of the sound levels that the receptor is accustomed to; and<br>As a residential area develops, the presence of people will result in increased dwelling-related sounds. These are generally a combination of traffic noises, voices, animals and equipment (including TVs and radios). The result is that ambient sound levels will increase as an area matures.<br><br>Calculating Noise Emissions – Adequacy Of Predictive Methods<br>Limitations due to the calculations of the noise emissions into the environment include the following:<br>• Many sound propagation models do not consider sound characteristics as calculations are based on an equivalent level (with the appropriate correction implemented e.g., tone or impulse). These other characteristics include intrusive sounds or amplitude modulation;<br>• Sound propagation models do not consider refraction through the various temperature layers (specifically relevant during the night-times);<br>• Most sound propagation models do not consider the low frequency range (third octave 16 Hz – 31.5 Hz). This would be relevant to facilities with a potentially low frequency issues;<br>• Many environmental models consider sound to propagate in hemi-spherical way. Certain noise sources (e.g., a speakers, exhausts, fans) emit sound power levels in a directional manner; |

| Specialist study | Assumptions and limitations |
|---|---|
| | • The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify;<br>• Many environmental models are not highly suited for close proximity calculations; and<br>• Acoustical characteristics of the ground are over-simplified, with ground conditions accepted as uniform. Ground conditions will not be considered in this assessment.<br><br>Due to these assumptions, modelling generally could be out with as much as +10 dBA, although realistic values ranging from 3 dBA to less than 5 dBA are more common in practice.<br><br>Adequacy Of Underlying Assumptions<br>Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds is also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.<br>As previously mentioned, it is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor but to calculate a noise rating level that is used to identify potential issues of concern.<br><br>Uncertainties Associated With Mitigation Measures<br>Any noise impact can be mitigated to have a low significance; however, the cost of mitigating this impact may be prohibitive, or the measure may not be socially acceptable (such as the relocation of an NSR). These mitigation measures may be engineered, technological or due to management commitment.<br>For the purpose of the determination of the significance of the noise impact mitigation measures were selected that is feasible, mainly focussing on management of noise impacts using rules, policy and require a management commitment. This, however, does not mean that noise levels cannot be reduced further, only that to reduce the noise levels further may require significant additional costs (whether engineered, technological or management).<br>It was assumed the mitigation measures proposed for the construction phase will be implemented and continued during the operational phase.<br><br>Uncertainties Of Information Provided<br>While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:<br>• This assessment did not include a noise audit to identify all potential noise sources nor to define the sound power emission levels of these activities (and equipment) within the focus area, but used aerial images to identify potential noise generating activities. These noise generating activities was used to develop the noise contours to illustrate the impact from existing activities.<br>• It is technically difficult and time-consuming to improve the measurement of spectral distribution of large equipment in an industrial setting. This is due to the many correction factors that need to be considered (e.g., other noise sources active in the area, adequacy of average time setting, surrounding field non-uniformity etc. as per SANS 9614-3:2005);<br>• That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;<br>• Sound power emission levels from processes and equipment changes depending on the load the process and equipment are subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario;<br>• As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions comply with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely be over-estimated;<br>• Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor;<br>• The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and |

| Specialist study | Assumptions and limitations |
|---|---|
| | Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information;<br>• The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and<br>• Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty per cent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions. |

# 14 Reasoned opinion as to whether the proposed activity should or should not be authorised

## 14.1 Reasons why the activity should be authorised or not

In terms of collectively considering ecological, social, and economic impacts it is important to remember that while there might be some trade-offs between the considerations, in South Africa all development must in terms of Section 24 of the Constitution be ecologically sustainable, while economic and social development must be justifiable. There are, therefore, specific "trade-off" rules that apply. Environmental integrity may never be compromised, and the social and economic development must take a certain form and meet certain specific objectives for it to be considered justifiable[3].

From all specialists' opinions, the impacts can be mitigated too medium to low. The only impact that remains high after mitigation is the visual impact.

All high significance impacts pre-mitigation will be lowered to medium and low significance impacts post-mitigation, except for visual impacts because of construction activities of stockpiles (to be located on the backfilled Lyleveld opencast pit) and roads that will cause topographical alteration, backfilling into the Lyleveld opencast pit that will alter the skyline but may be a net positive impact.

The EAP is of opinion that the project should be authorised.

## 14.2 Conditions that must be included in the authorisation

### 14.2.1 Specific conditions to be included into the compilation and approval of the EMPr

Should the DMRE grant authorisation for SIOM, it should be subject to the following conditions:

- No vegetation clearance may be allowed to commence prior to obtaining the necessary permits and clearly demarcating all areas to be cleared. The ECO responsible for environmental compliance on site should further be allowed to implement any additional measures he/she deems necessary

[3] Guideline on need and desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (GN 891 of 20 October 2014)

and the associated necessary training (e.g. ecological, hydrocarbon management etc.) should be incorporated into the contractors' induction.

- Ongoing development and implementation of dust management programme.
- Limiting exposed areas throughout all stages of mine operations.
- Work in rivers, streams and wetlands should preferably be done during the low flow season to minimise fauna impact since fauna activity increase during the wet season.
- All pans affected by the project should be inspected regularly for sedimentation and erosion.
- Implementation of the necessary storm water management measures to avoid discharge or seepage of affected water into the natural surface water environment.
- Status quo groundwater monitoring should continue to include quality and water level monitoring with regular interpretation of results by a qualified and professional geohydrologist.
- Monitoring and management of the natural surface water environment should also receive priority. Degradation of these natural systems should be avoided.
- Decommissioning of the facilities should entail final rehabilitation, i.e., re-shaping to enhance free drainage / surface run-off, top soiling and seeding.
- Water quality monitoring must be conducted in pans MW 1 and MW 4 when there is water in the pans.

# 15 Period for which Environmental Authorisation is required

The remaining life of mine is currently estimated to be at least until 2039. The period for which the environmental authorisation is required is 17 years.

# 16 Undertaking

The undertaking by the EAP is provided in Section 2 of Part B below. This undertaking confirms: the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

# 17 Financial provisions

## 17.1 Explain how the aforesaid amount was derived

The closure liability was calculated in line with the promulgated Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN No. R. 1147, 20 November 2015) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998). A database was compiled, containing each structure and disturbed area. The liability was calculated per line item based on the area measured / volume obtained and multiplied with the applicable contractor rate.

The calculation was split per the alternatives for the proposed activities:

- Alternative 1 (preferred alternative);
- Alternative 2.

Main assumptions made while calculating the liability:

- The liability was calculated in line with the closure objectives and criteria in the 2022 closure liability report (EXM, 2022).
- Closure liability related to open pit rehabilitation (access control via trench & berm and fencing) is assumed to be covered under the current financial provision (EXM, 2023), since the proposed expansion assumed to fall within Zone of Relaxation ("ZoR") (further studies required to determine ZoR).
- The rates used were provided by Quantity Surveyors, obtained in 2023, unless otherwise specified.
- Quantities measured from Google Earth / GIS unless otherwise specified.

The closure liability consists of the following categories:

- Physical - Demolition of infrastructure where infrastructure does not form part of end land use,
- Biophysical - Actions to safeguard (making safe and stable) and re-establish the biophysical to ensure a sustainable landform and mitigate identified risks. This includes ripping disturbed areas and seeding some of the ripped areas (where vegetation could not establish naturally), and
- Post closure management – Actions required as part of aftercare after the mine has been closed.

The liability for the different alternatives, including contingency (10%), P&Gs (20%) and excluding VAT is:

- Alternative 1: R19,975,486.58;
- Alternative 2: R20,184,914.04;

Refer to the Table 23 below for the calculations discussed above.

## 17.2 Confirm that this amount can be provided for from operating expenditure

SIOC uses bank guarantees. Once the project is approved and a condition is issued by the DMRE to make the provision then SIOC will apply for the new guarantee.

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*Table 23: Financial provisions calculations for Sishen Expansion Project*

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 1 | Admin office | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 358.00 | m² | 1.00 | 358.00 | R707.49 | R253,281.42 | R253,281.42 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 2 | Simulator area | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Temporary office 6m | 18.00 | m² | 1.00 | 18.00 | R1,866.92 | R33,604.56 | R33,604.56 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 3 | GCC plant office | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 339.00 | m² | 1.00 | 339.00 | R707.49 | R239,839.11 | R239,839.11 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 4 | Production office | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 232.00 | m² | 1.00 | 232.00 | R707.49 | R164,137.68 | R164,137.68 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 5 | Shift change | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 179.00 | m² | 2.00 | 358.00 | R707.49 | R253,281.42 | R253,281.42 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 6 | GCC shift change | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 179.00 | m² | 2.00 | 358.00 | R707.49 | R253,281.42 | R253,281.42 | |
| Physical | Moolmans Maintenance Workshop, access road | 7 | GCC training | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 157.00 | m² | 1.00 | 157.00 | R707.49 | R111,075.93 | R111,075.93 | |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | and proposed pollution control dam | | | | | | | | | | | | | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 8 | Boiler room | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 16.72 | m² | 3.00 | 50.16 | R707.49 | R35,487.70 | R35,487.70 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 9 | Lube storage | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Temporary office 12m | 36.00 | m² | 5.00 | 180.00 | R1,866.92 | R336,045.60 | R336,045.60 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 10 | Store | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Multi-level double brick building | 319.00 | m³ | 1.00 | 319.00 | R892.77 | R284,793.63 | R284,793.63 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 11 | HME Workshop | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Multi-level double brick building | 1,752.00 | m³ | 1.00 | 1,752.00 | R892.77 | R1,564,133.04 | R1,564,133.04 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 12 | LDV workshop | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 756.00 | m² | 1.00 | 756.00 | R707.49 | R534,862.44 | R534,862.44 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 13 | Waste bin area | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 141.00 | m³ | 1.00 | 141.00 | R278.38 | R39,251.58 | R39,251.58 | |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 14 | Boiler shop | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | Included in HME Workshop measurement |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 15 | GET yard | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 2,539.00 | m³ | 1.00 | 2,539.00 | R278.38 | R706,806.82 | R706,806.82 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 16 | HME & LDV washbay | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 347.00 | m³ | 1.00 | 347.00 | R278.38 | R96,597.86 | R96,597.86 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 17 | OTR tyre storage | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 439.00 | m³ | 1.00 | 439.00 | R278.38 | R122,208.82 | R122,208.82 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 18 | Truck navigation | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | No data |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 19 | OTR workpad | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 5,484.00 | m³ | 1.00 | 5,484.00 | R278.38 | R1,526,635.92 | R1,526,635.92 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed | 20 | Toilets & dressing rooms | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 60.90 | m² | 1.00 | 60.90 | R707.49 | R43,086.14 | R43,086.14 | |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pollution control dam | | | | | | | | | | | | | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 21 | Offices 1,2,3 | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 12.20 | m² | 1.00 | 12.20 | R707.49 | R8,631.38 | R8,631.38 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 22 | Training & Caucus room | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 40.60 | m² | 1.00 | 40.60 | R707.49 | R28,724.09 | R28,724.09 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 23 | RIM storage | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Temporary office 12m | 36.00 | m² | 1.00 | 36.00 | R1,866.92 | R67,209.12 | R67,209.12 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 24 | N2 compressor room | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | Included in *Wheel Assembly* cost |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 25 | Tool store | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Temporary office 6m | 18.00 | m² | 1.00 | 18.00 | R1,866.92 | R33,604.56 | R33,604.56 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 26 | Tyre press | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | No cost incurred | 0.00 | n/a | 5.00 | 0.00 | R0.00 | R0.00 | R0.00 | Included in *Wheel Assembly* cost |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 27 | Wheel assembly | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 340mm concrete structures | 1,126.00 | m³ | 1.00 | 1,126.00 | R278.38 | R313,455.88 | R313,455.88 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 28 | Caucus room | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Single storey double brick building | 157.00 | m² | 1.00 | 157.00 | R707.49 | R111,075.93 | R111,075.93 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 29 | Fire water pump station | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Pumps & pump rooms | 203.00 | m² | 1.00 | 203.00 | R566.20 | R114,938.60 | R114,938.60 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 30 | Potable water tank | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Water tanks | 2.00 | no | 1.00 | 2.00 | R560.08 | R1,120.16 | R1,120.16 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 31 | Raw water tank | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Water tanks | 2.00 | no | 1.00 | 2.00 | R560.08 | R1,120.16 | R1,120.16 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 32 | Chlorination plant | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Steel tanks | 2.00 | no | 1.00 | 2.00 | R1,052.00 | R2,104.00 | R2,104.00 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed | 33 | Washbay pumpstation | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Pumps & pump rooms | 78.30 | m² | 1.00 | 78.30 | R566.20 | R44,333.46 | R44,333.46 | |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pollution control dam | | | | | | | | | | | | | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 34 | Sewer conservance tank | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Steel tanks | 1.00 | no | 1.00 | 1.00 | R1,052.00 | R1,052.00 | R1,052.00 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | 35 | Mini substation | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Infrastructure: Sub-stations | 2.00 | no | 1.00 | 2.00 | R33,417.82 | R66,835.64 | R66,835.64 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | Overhead crane | N/A | EIA/EMPR (Shangoni, 2023) | Workshop cranes | 1.00 | no | 1.00 | 1.00 | R8,089.98 | R8,089.98 | R8,089.98 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | Parking bays | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | 250mm concrete structure | 614.75 | m³ | 1.00 | 614.75 | R867.11 | R533,055.87 | R533,055.87 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | Disturbed area | N/A | K1699 Moolmans Runoff Sketch (002) Google Earth | Ripping | 103,797.00 | m² | 1.00 | 103,797.00 | R4.79 | R497,187.63 | R497,187.63 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | PCD | Both | K1699-F-I12626-DC-DRW-C0004-0026_PCD LAYOUT DETAILS_REV_A (1) Google Earth | Drain dam, leave to dry, remove liner | 13,726.00 | m² | 1.00 | 13,726.00 | R101.51 | R1,393,326.26 | R1,393,326.26 | |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | PCD | Both | K1699-F-I12626-DC-DRW-C0004-0026_PCD LAYOUT DETAILS_REV_A (1) Google Earth | Earthworks, break-up of concrete, etc. and level | 13,726.00 | m² | 1.00 | 13,726.00 | R64.12 | R880,111.12 | R880,111.12 | |
| Physical | Moolmans Maintenance Workshop, access road and proposed pollution control dam | | PCD | Both | K1699-F-I12626-DC-DRW-C0004-0026_PCD LAYOUT DETAILS_REV_A (1) Google Earth | Breaking up of concrete silt trap liner including inlet and outlet | 635.00 | m² | 1.00 | 635.00 | R83.08 | R52,755.80 | R52,755.80 | |
| Biophysical | Tyre storage yard expansion | | Ripping | Both | GIS | Ripping | 45,000.00 | m² | 1.00 | 45,000.00 | R4.79 | R215,550.00 | R215,550.00 | |
| Biophysical | Open pit | | Open pit expansion | N/A | GIS | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | Assume trench, berm & fence included in current financial provision (EXM, 2022) |
| Biophysical | Open pit | | PB 19 pit | N/A | GIS | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | Assume trench, berm & fence included in current financial provision (EXM, 2022) |
| Biophysical | Lylyveld pit | | Pit expansion incl C&G stockpile | N/A | GIS | No cost incurred | 0.00 | n/a | 1.00 | 0.00 | R0.00 | R0.00 | R0.00 | Assume trench, berm & fence included in current financial provision (EXM, 2022) |
| Biophysical | Lylyveld pit | | Pit expansion incl C&G stockpile | N/A | GIS | Levelling backfilled material | 11.60 | ha | 1.00 | 11.60 | R137,750.95 | R1,597,911.02 | R1,597,911.02 | |
| Biophysical | Open pit | | Haul roads | Alt 1 | GIS | Ripping | 40,000.00 | m² | 1.00 | 40,000.00 | R4.79 | R191,600.00 | R0.00 | |
| Biophysical | Open pit | | Haul roads | Alt 2 | GIS | Ripping | 50,000.00 | m² | 1.00 | 50,000.00 | R4.79 | R0.00 | R239,500.00 | |
| Biophysical | General | | Seeding disturbed areas | Alt 1 | GIS | Seeding | 23,000.00 | m² | 5.00 | 115,000.00 | R15.20 | R1,748,000.00 | R0.00 | Only included Moolmans, tyre storage and haul roads, seeding of pit berms included in current fin pro (EXM, 2022). Assume 10% of area to be vegetated in in line with EXM liability calculation |
| Biophysical | General | | Seeding disturbed areas | Alt 2 | GIS | Seeding | 24,000.00 | m² | 5.00 | 120,000.00 | R15.20 | R0.00 | R1,824,000.00 | Only included Moolmans, tyre storage and haul roads, seeding of pit berms included in current fin pro (EXM, 2022). Assume 10% of area to be vegetated in |

| Classification | Area | Ref number | Description | Alternative | Source of Information | Rate category | Quantity | Unit | Number / other/ factor | Total Size | Rates | Alternative 1 total | Alternative 2 total | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | line with EXM liability calculation |
| Prost closure management | General | | Post rehabilitation maintenance | Alt1 | GIS | Maintenance | 23.00 | ha/year | 5.00 | 115.00 | R7,439.61 | R855,555.15 | R0.00 | Only included Moolmans, tyre storage and haul roads, assume pit areas monitoring included in current financial provisioning (EXM, 2022) |
| Prost closure management | General | | Post rehabilitation maintenance | Alt 2 | GIS | Maintenance | 24.00 | ha/year | 5.00 | 120.00 | R7,439.61 | R0.00 | R892,753.20 | Only included Moolmans, tyre storage and haul roads, assume pit areas monitoring included in current financial provisioning (EXM, 2022) |
| Sub-total 1 | | | | | | | | | | | | **R15,365,758.90** | **R15,526,856.95** | |
| Preliminary & General (20%) | | | | | | | | | | | | R3,073,151.78 | R3,105,371.39 | |
| Contingency (10%) | | | | | | | | | | | | R1,536,575.89 | R1,552,685.70 | |
| Sub-total 2 | | | | | | | | | | | | **R19,975,486.58** | **R20,184,914.04** | |
| VAT (15%) | | | | | | | | | | | | R2,996,322.99 | R3,027,737.11 | |
| Grand total | | | | | | | | | | | | R22,971,809.56 | R23,212,651.15 | |

# 18 Deviations from the approved scoping report and plan of study

Orginally the Sishen Expansion Project at SIOM comprised of further pit expansions that include Far south pushback 21 and 19, Lylyveld pit expansion, C&G stockpile at Far south and Lylyveld pit, Moolmans workshop, access road and pollution control dam, proposed Far south Waste Rock Dump, heavy and light vehicle crossing, expansion of the existing tyre storage area, heavy mining equipment parkup area, proposed haul roads, and associated mining infrastructure, proposed rerouting of telephone line, powerline and pipelines.

However, due to project timelines associated with obtaining all applicable environmental authorisation, permits and licences for Pushback 21, a decision was made to exclude Pushback 21 and associated infrastructure (haul road, heavy mining equipment park up ("HME"), rerouted powerline, waterline and telephone line, C&G stockpile, associated waste rock dump and road crossing) from this Environmental Authorisation application, in consultation with the Department of Mineral Resources and Energy ("DMRE"). Further thereto, as the waste rock dump is excluded from this application, a waste management licence is no longer required. To this end, an updated Environmental Authorisation application was submitted to DMRE on 4 May 2023, with instruction from DMRE to continue with the EIA phase of the project.

The Sishen Expansion Project at SIOM now comprises of further pit expansions that include Far south pushback 19, Lylyveld pit expansion, C&G stockpile at Lylyveld pit, Moolmans workshop, access road and pollution control dam, expansion of the existing tyre storage area, heavy, proposed haul roads, and associated mining infrastructure

# 19 Other information required by the competent authority

Refer to table 7 in section 6.4 of Part A for information requested from the Northern Cape Department of Mineral Resources and Energy

## 19.1 Compliance with the provisions of section 24(4)(a) and (b) read with section 24(3)(a) and (7) of the National Environmental Management Act 107 of 1998

### 19.1.1 Impact on the socio-economic conditions of any directly affected person

| Results of investigation, assessment and evaluation of impact on any directly affected person | Reference to where mitigation is reflected |
|---|---|
| During the Life of Mine, SIOM aims:<br>• To promote employment and advance the social and economic welfare of all employees and uplift all stakeholders within the communities in which they operate. | Refer to Section 1.4 of Part B. |

| Results of investigation, assessment and evaluation of impact on any directly affected person | Reference to where mitigation is reflected |
|---|---|
| • To contribute to the transformation of the industry.<br>• To ensure that the holders of mining rights contribute to the socio-economic development of the communities in which they operate. | |

### 19.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act 25 of 1999

| Results of investigation, assessment and evaluation of impact on any directly affected person | Reference to where mitigation is reflected |
|---|---|
| No archaeological or historical sites are directly affected by the Sishen Expansion Project. No infrastructure is located close to the identified lithics (Early Stone Age, Middle Stone Age and Later Stone Age) located in the quarry. | Section 1.4 of Part B. |

# 20 Other matters required in terms of section 24(4)(a) and (b) of the Act

An impact assessment for the Sishen Expansion Project has been undertaken using qualified specialists, which has incorporated extensive consultation with and participation of interested and affected parties. Applying the hierarchical approach to impact management, alternatives were firstly considered to avoid negative impacts, but where avoidance was not possible, to better mitigate and manage negative impacts. Where impacts were found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed. Furthermore, the environmental impact statement in Section 10 of Part A summarises the key findings of the environmental impact assessment. No other matters were identified in terms of section 24(4)(a) and (b) of the act.

# PART B

# ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

## 1 Draft environmental management programme

### 1.1 Details of the EAP

The requirements for the provision of the detail and expertise of the EAP are included in Section 1.2 of Part A.

### 1.2 Description of the aspects of the activity

The requirement to describe the aspects of the activity that are covered by the draft environmental management programme is included in Section 6.5 of Part A.

### 1.3 Composite map

Refer to Figure 7, Figure 22 as well as Annexure A for a map that superimposes Sishen Expansion Project associated structures and infrastructures on the environmental sensitivities of the preferred sites.

## 1.4 Description of the impact management outcomes and actions

*Table 24: Mitigation measures for the Sishen Expansion Project*

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Geology | Moolmans PCD | Alternative 1 (preferred) | Construction, operation, decommissioning and closure of mining infrastructure. | Not applicable. | None | Impacts on the geology due to mining of the pit, PB 19 and Lyleveld pit are unavoidable due to the nature of mining. However, mining will only take place according to the LOM plan. | To extract the iron ore resource as efficiently as possible. Optimally extracting the iron ore resource by using current technology. | 1-17 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | Not applicable. | None | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | Unavoidable impact to geology. | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion | No alternatives | | | | | | |
| 2 | Topography | Moolmans PCD | Alternative 1 (preferred) | | The proposed Moolman PCD will influence the nature of the topography as the excavated material will be stockpiled at existing approved Western WRD. This increasing the height of the WRD and increasing the amount of run-off from site as the existing WRD has a higher surface area than the flat plains. | Control | • The disturbance area for the construction will be kept at a minimum and in the designated areas as per the approved layout plans. | Outcome:<br>Ensure minimum change in topography.<br>Preserve sufficient soil volumes to enable pre-mining land capability post-rehabilitation.<br>Standard:<br>Principles in the MPRDA, 2002, NEMA, 1998, NEM:WA, 2008, Regulations there under and amendments thereto.<br>National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GNR.331 of 2014), thereunder.<br>Rehabilitation, decommissioning- and closure plan and closure objectives. | 1-17 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | The proposed Tyre expansion area will not influence the nature of the topography as the height of the Tyre expansion area will be the same as the surrounding environment. | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | The proposed Lyleveld C&G stockpile will influence the nature of the topography as the stockpiled material will be higher than the surrounding areas increasing the amount of runoff from site as the stockpile will have a higher surface area than the flat surrounding plains as the C&G stockpile will be placed on the backfilled (total) existing pit area. | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion | No alternatives | | Expansion of the pit will influence the topography. | | | | |
| 3 | Soils, land use and land capability | Moolmans PCD | Alternative 1 (preferred) | Clearing of soil | The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Control | • The disturbance area for the construction will be kept at a minimum and in the designated areas as per the approved layout plans.<br>• Topsoil will be stripped from the proposed footprint areas before construction starts.<br>• Should these stockpiles become a source of windblown dust, they must be vegetated with indigenous vegetation.<br>• All alien invasive flora should be removed from the stockpiles.<br>• Mining to take place according to the mine plan. | | |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | | Control and prevention | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | | Control and prevention | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion | No alternatives | Expanding the pit | Expansion of the pit will cause loss of soils, causing change of land use and impact the land capability. | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Lyleveld pit | Not applicable | Expanding of the pit | | | | | |
| 4 | Surface water | Pit expansion and Pushback 19 | Not applicable<br>Not applicable | Initial creation of PB 19<br>Expanding of the pit | There may be a deterioration in surface water quality when any surface water runoff comes into contact with dust, eroded soil, or other pollutants generated during the construction phase of the Project. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered.<br>Surface water quality:<br>Siltation of water resources causes deterioration of water quality, affecting the use of surface water as a natural resource. | Avoid, modify, remedy, control or stop | • Disturbed areas to be limited to the footprint as depicted in the layout plan.<br>• The laydown areas for each construction site must be kept as small as reasonably possible.<br>• Place topsoil stockpiles in designated areas with measures in place to prevent erosion and to minimise deposition of sediment in the downstream environment.<br>• Where possible, construction activities should be scheduled to coincide with the dry season. | Outcome:<br>To reduce erosion and siltation resulting from the construction phase.<br>To prevent surface water quality deterioration due to chemical contamination.<br>To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment.<br>Standard:<br>National Water Act, 1998 and associated Regulations. | ±5 years |
| | | Lylyveld pit expansion | Not applicable | Initial creation of PB 19 | | | | | |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred) | Construction of Moolmans Workshop and PCD | | | | | |
| | | | PCD alternative 2 | | | | | | |
| | | Moolmans haul road | Not applicable | Construction of Moolmans haul road | | | | | |
| | | | Alternative 1 (preferred) | | | | | | |
| | | Tyre expansion area | Alternative 2 | Construction of tyre expansion | | | | | |
| | | Pit expansion and Pushback 19 | Not applicable | Initial creation of PB 19 and expansion of the pit | Spillages of hazardous materials (i.e., cement, oil, fuel and / or grease) used during the construction phase of the Project may impact on the surrounding clean water environment.<br>Surface water quality:<br>Deterioration of water quality due to chemical contamination affecting the use of surface water as a natural resource. | Avoid, modify, remedy, control or stop | • Treat all hydrocarbon spills as hazardous waste and dispose of accordingly.<br>• Emergency spill kits should be available and emergency spills to be cleaned up quickly and effectively with approved absorbent material.<br>• Ensure that mixing practices are conducted on impermeable surfaces.<br>• All vehicle and equipment usage should be limited to designated areas only.<br>• Store fuel and oil in designated bunded areas.<br>• Refuelling of vehicles to take place on an impermeable surface fitted with a sump to contain any spillages.<br>• Divert clean surface water runoff around construction areas (implementation of proposed storm water management practices). | Outcome:<br>To prevent / reduce surface water quality deterioration resulting from erosion, siltation, and pollution.<br>To preserve surface water quality that enters the receiving environment.<br>To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment.<br>Standard:<br>National Water Act, 1998 and associated Regulations. | ±5 years |
| | | Lylyveld pit expansion | Not applicable | Expanding of the pit | | | | | |
| | | Moolmans Maintenance Workshop | PCD alternative 1 (preferred) | Construction of Moolmans Workshop and PCD | | | | | |
| | | | PCD alternative 2 | | | | | | |
| | | Moolmans haul road | Not applicable | Construction of Moolmans haul road | | | | | |
| | | Tyre expansion area | Alternative 1 (preferred) | Construction of tyre expansion | | | | | |
| | | | Alternative 2 | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Pit expansion and Pushback 19 | Not applicable | Pit areas and Pushback 19 | The mine planners have identified several areas where the pit boundary will expand over the next few years. This will result in the pit boundary being expanded by an additional 40 ha. Inclusive in this pit boundary is Pushback 19 that will occupy an area of 15 ha.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Avoid, modify, remedy, control or stop | • It is recommended to construct a small (0.5 m) diversion/containment berm around the open pit areas to prevent any clean runoff from entering the open pit areas. The aim of this strategy is to reduce impacts on surface water quantity. | Outcome:<br>To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment.<br>Standard:<br>National Water Act, 1998 and associated Regulations. | 15 years |
| | | Lyleveld pit | Not applicable | Lylyveld pit | It is proposed to expand the Lylyveld Pit area by 110 ha over and above the existing 15 ha area.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Avoid, modify, remedy, control or stop | • It is recommended to construct a diversion/containment berm around the open pit areas to prevent any clean runoff from entering the open pit areas. The aim of this strategy is to reduce impacts on surface water quantity.<br>• It is anticipated that ponding may occur against the berm in low lying areas. Therefore, considering the inherent risk of ponding of water, the siting of the berm should consider the potential safety risk related to highwall stability. | | 15 years |
| | | | PCD alternative 1 (preferred) | | A new workshop (Moolmans Maintenance Workshop) is proposed to be constructed | | • A new workshop (Moolmans Maintenance Workshop) is proposed to be constructed close to the | Outcome: | 15 years |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Moolmans Maintenance Workshop | PCD alternative 2 | Utilisation of Moolmans Workshop and PCD | close to the Nooitgedacht filling station. The workshop will occupy an area of 6.5 ha.<br>The proposed workshop area includes for several infrastructure that includes for the chemical, hydrocarbon and hydraulic storage, affected water facilities, wash bays and other infrastructure (refer to list of associated infrastructure provided in section 1.4 above. Should any spillages of hydrocarbons or affected water occur, such may pollute any clean water runoff.<br>Runoff generated upstream of the Moolmans Maintenance Workshop will drain northwards towards the facility and if left unmitigated, clean runoff could come into contact with substances that have the potential to pollute surface water (i.e., emulsion, oil, fuel and / or grease) and reduce water quality.<br>Further, the proposed Moolmans Maintenance Workshop will be constructed with an affected water management network and a PCD to contain any potentially affected water runoff.<br>Surface water quality:<br>Deterioration of surface water quality due chemical / hydrocarbon contamination resulting from leaks, spillages or bursting tanks, affecting the use of surface water as a natural resource.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Avoid, modify, remedy, control or stop | Nooitgedacht filling station. The workshop will occupy an area of 6.5 ha.<br>• The proposed workshop area includes for several infrastructure that includes for the chemical, hydrocarbon and hydraulic storage, affected water facilities, wash bays and other infrastructure (refer to list of associated infrastructure provided in section 1.4 above. Should any spillages of hydrocarbons or affected water occur, such may pollute any clean water runoff.<br>• Runoff generated upstream of the Moolmans Maintenance Workshop will drain northwards towards the facility and if left unmitigated, clean runoff could come into contact with substances that have the potential to pollute surface water (i.e., emulsion, oil, fuel and / or grease) and reduce water quality.<br>• Further, the proposed Moolmans Maintenance Workshop will be constructed with an affected water management network and a PCD to contain any potentially affected water runoff.<br>• Surface water quality:<br>• Deterioration of surface water quality due chemical / hydrocarbon contamination resulting from leaks, spillages or bursting tanks, affecting the use of surface water as a natural resource.<br>• Surface water quantity:<br>• There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | To reduce erosion and siltation resulting from the construction phase.<br>To prevent surface water quality deterioration due to chemical contamination.<br><u>Standard:</u><br>National Water Act, 1998 and associated Regulations. | |
| | | Tyre expansion area | Alternative 1 (preferred)<br>Alternative 2 | Tyre expansion | It is proposed to expand the existing Tyre Storage Yard by an additional 4.5 ha.<br>The expansion area will be aligned with the existing tyre storage area and constructed with a slightly elevated and concreted surface, fenced, and fitted with the appropriate fire protection management system.<br>Although the tyres themselves may not result in any potential pollution of water, should the tyres be contaminated with chemicals and dust from the operation, any potential runoff from the storage area may result in decrease in the quality of surface water runoff. Further thereto, should a fire occur, chemicals and other pollutants may be released. Any surface water runoff will become contaminated.<br>Surface water quality:<br>Siltation and contaminated runoff will result in a deterioration of water quality, affecting the use of surface water as a natural resource. | Avoid, modify, remedy, control or stop | • Ensure that tyres brought to the storage area are not contaminated with any substances.<br>• Ensure the corect and applicable fire protection equipment is available at all times.<br>• Ensure that the waste tyres are handled and stored in accordance to the Waste Tyre Regulations, 2017. | <u>Outcome:</u><br>To prevent surface water quality deterioration due to chemical contamination.<br><u>Standard:</u><br>National Water Act, 1998 and associated Regulations. | 15 years |
| | | | Alternative 1 (preferred) | | | | | | 15 years |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Lylyveld C & G stockpiles and backfilled area | Alternative 2 | Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | It is proposed to backfill the existing extent of the Lylyveld Pit and construct a C & G Stockpile on the backfilled area.<br>The contamination is expected to be limited to predominantly red dust that has a low pollution risk. The dust discolours the storm water runoff but is inert. The stockpiling area will also contain material particles that can be suspended by runoff generated during rainfall events, increasing the sediment load of runoff and reducing surface water quality.<br>The proposed containment berm around the product stockpile will reduce surface water quality impacts but it will lead to a reduction in clean runoff water reporting to the downstream catchment.<br>Surface water quality:<br>Siltation will result in a deterioration of water quality, affecting the use of surface water as a natural resource. | Avoid, modify, remedy, control or stop | • It is recommended to construct a diversion/containment berm around the proposed area to prevent clean runoff from entering this area and to prevent affected runoff from leavng this area. The aim of this strategy is to seperate clean and affected runoff in order to limit surface water quality impacts.<br>• It is anticipated that ponding may occur against the berm in low lying areas. Therefore, considering the inherent risk of ponding of water, the siting of the berm should consider the potential safety risk related to highwall stability. | Outcome:<br>To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment.<br>Standard:<br>National Water Act, 1998 and associated Regulations. | |
| | | Lylyveld pit expansion | Not applicable | Expansion of the Lylyveld Pit | The mine planners have identified several areas where the pit boundary will expand over the next few years. This will result in the pit boundary being expanded by an additional 40 ha. Inclusive in this pit boundary is Pushback 19 that will occupy an area of 15 ha.<br>Good practice, as implemented at SIOM involves the construction of a berm around open pit areas for the diversion of water around the open pit. However, any water accumulation within the pit is retained within the mines affected water management system. This will lead to a reduction in the amount of runoff reporting to the catchment.<br>However, due to the topography of the area, it is expected that clean surface water runoff will pond against the proposed berm to the west of the expansion area within a valley.<br>Surface water quantity:<br>There will be a decrease in clean water runoff reporting to the catchment, potentially reducing the availability of water to downstream users. | Avoid, modify, remedy, control or stop | • It is recommended to construct a diversion/containment berm around the open pit areas to prevent any clean runoff from entering the open pit areas. The aim of this strategy is to reduce impacts on surface water quantity and prevent the ingress of clean surface water runoff into the pit.<br>• It is anticipated that ponding may occur against the berm in low lying areas. Therefore, considering the inherent risk of ponding of water, the siting of the berm should consider the potential safety risk related to highwall stability. | Outcome:<br>To minimise surface water losses to the larger catchment area by ensuring effective drainage of surface runoff to the downstream environment.<br>Standard:<br>National Water Act, 1998 and associated Regulations. | 1 5 years |
| 5 | Groundwater | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | The impacts on groundwater quality are primarily related to the management of materials, wastes and spills and unauthorised disposal of contaminated substances. Contamination of groundwater may also arise due to incorrect handling and disposal of waste materials. This risk is considered low. A very limited groundwater quality impact is expected during the construction phase, generally because of the small surface areas involved and the short duration thereof. | Avoid, modify, remedy, control or stop | • Develop and maintain a Standard Operating Procedure to contain and remediate any accidental hydrocarbon or other chemical spillages.<br>• Contain spillage, excavate, and dispose of soil if required. Utilisation of spill kits and/or excavation of affected soil with subsequent disposal at an accredited disposal site is crucial.<br>• Continue with the status quo groundwater monitoring programme.<br>• All vehicles must be properly maintained and serviced so that no oil leaks occur on site. | Prevent or contain groundwater contamination | 5-10 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion | No alternatives | Expanding the existing pit | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Lyleveld pit expansion | | Expanding the existing pit | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred)<br>Alternative 2 | Operating the PCD | Influx of groundwater into open voids result a subsequent lowering of groundwater levels due to dewatering with a potential loss in resource. | | • Due to the low permeability of the host rock a steep hydraulic gradient towards the pits exists resulting in limited extents of depression cones of dewatering.<br>• Groundwater users are located beyond the dewatering impact zone. If any mine related loss of water supply is experienced by the surrounding landowners, provision should be made for compensation that could include an alternative water supply of equivalent water quality.<br>• The existing monitoring programme should be augmented to include boreholes within the impact zone to continue to monitor the groundwater drawdown. | Prevent, contain, or minimise groundwater impact | 10-17 years |
| | | Tyre expansion | Alternative 1 (preferred)<br>Alternative 2 | Operation of the tyre storage area | | | | | |
| | | Pit expansion<br>Lyleveld pit expansion | No alternatives | Expanding the existing pit | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the PCD | Ceasing of dewatering and rehabilitation (during closure) will lead to gradual recovery of ambient groundwater levels. However, because most remaining voids will only partially be backfilled, a gradient towards the voids will remain and therefore the re-establishment of groundwater levels, flow directions and flow gradients to near pre-mining levels will not occur. | | | | |
| | | Tyre expansion | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the tyre area | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | |
| | | Pit expansion<br>Lyleveld pit expansion | No alternatives | Expanding the existing pit | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the PCD | Seepage and/or stormwater run-off from the backfilled facilities can potentially result in groundwater contamination. Metals (Al, Fe and Mn) may have the potential to leach from the material, but the most significant impact expected is from major ions such as Mg, K, Na, Cl and SO4 enrichment. | | • Waste rock was characterised as non-acid generating and metals (Al, Fe and Mn) are most likely to be attenuated in the sub-surface.<br>• Due to the low permeability of the host rock a steep hydraulic gradient towards the pits exists and plume migration is limited.<br>• Groundwater users are located beyond the impact zone. If any mine related loss of water supply is experienced by the surrounding landowners the mine should assist these landowners in supplying an alternative water supply of equivalent water quality. | | |
| | | Tyre expansion | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the tyre area | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred)<br>Alternative 2 | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | |
| | | Pit expansion<br>Lyleveld pit expansion | No alternatives | Cease mining in the existing pit | | | | | |
| 6 | Biodiversity (flora) | Moolmans PCD | Alternative 1 (preferred)<br>Alternative 2 | Construction of Moolmans PCD. | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the | Control | • Mitigation measures include limiting the footprint area, restricting the footprint area to areas of lower sensitivity as far as practicable, and adherence to DAFF permit guidelines.<br>• Mitigation measures include vegetation clearing kept to the minimum.<br>• All areas to be cleared must be demarcated. | Prevent or minimise terrestrial biodiversity impact | 1-5 years |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion. | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 2 | | migration of fauna and flora between areas on an ecosystem scale.<br>Approximately 15 ha Ecological Support Area ("ESA") and 3 ha Other Natural Area ("ONA"). The ESA identified on site habitat consist predominantly of thicket areas having a varying ratios of *Senegalia mellifera*, *Ziziphus mucronata, Grewia flava* and to a lesser extent *Rhigozum trichotomum.* A variety of grass species is present on-site.<br>Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale. | | • Soil disturbance and vegetation clearing should be kept to minimum.<br>• Cleared areas that are not going to be used should be revegetated with locally-collected seed of indigenous species.<br>• All staff and contractors should undergo an environmental induction course by the environmental officer. | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion including PB 19 | No alternatives | Further pit expansions and creation of PB 19 | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of protected flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br>Approximately 15 ha Ecological Support Area ("ESA") and 3 ha Other Natural Area ("ONA"). The ESA identified on site habitat consist predominantly of thicket areas having a varying ratios of *Senegalia mellifera*, *Ziziphus mucronata, Grewia flava* and to a lesser extent *Rhigozum trichotomum.* A variety of grass species is present on-site.<br>Moderately sensitive areas such as *Boscia albitrunca* associated grasslands are less represented while providing more significant ecological and diversity functioning. Loss of protected flora specimens due to clearing of areas for development, which includes protected and locally endemic species. These areas are of value as they serve as links to allow the migration of flora between areas on an ecosystem scale. | Control and prevent | | | |
| | | Lyleveld pit | No alternatives | Expanding the existing pit | Approximately 0.2 ha Other Natural Area ("ONA") | Control | | | |
| | | Moolmans PCD | Alternative 1 (preferred) | Operation of Moolmans PCD | Loss of sensitive habitats.<br>Loss of topsoil, seedbank, microbial resources through physical disturbance. Soil resources are disturbed by means of removal and compaction, as well as polluted due to accidental spills and leaks. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site. | Control and prevent | DEFF should be engaged to indicate potential reduction, compensation or offsets required for the negative impact on the protected species. The EO should enforce any measures that he/she deem necessary to minimise destruction and damage to the environment and specifically wetlands outside of the footprint areas of the mining activities. Regular environmental training should be provided to construction workers to ensure the protection of the wetland habitat. Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the | Prevent or rminimise terrestrial biodiversity impact | 5-10 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Operation of the tyre storage area | | | | | |
| | | | Alternative 2 | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Operation of the C&G stockpile | Air pollution from operational activities such as transportation of waste. | | demarcated area. Areas and/or individual flora specimens to be avoided must be clearly demarcated before initiation of the site clearance phase as no-go areas. Any nationally protected trees within proximity of the development footprint to be identified as no-go areas or special permits obtained to remove the trees, meeting the obligations of such permits issued. The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of vegetation clearance or construction. Ensure all geophytes not concurrently used is stockpiled for re-use in future rehabilitation. | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld pit | No alternatives | Expanding the existing pit | | | | | |
| | | Pit expansion | No alternatives | Mining activities to enlarge the pit size | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | The removal of natural vegetation is regarded as a significant impact. However, should rehabilitation to as close as pre-mining conditions be undertaken appropriately and adequately, as well as the control of alien invasive species, a residual impact on vegetation may be prevented. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site.<br>Air pollution from operational activities such as transportation of waste. The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Control | • Wastes will be removed and disposed of at an appropriately licensed landfill (facility disposal licenses will be verified) and recyclables will be taken to a licensed recycling facility.<br>• Mechanical erosion control methods will be implemented if required. This may include the use of geotextiles.<br>• Re-vegetation will be conducted through hand seeding exposed areas using indigenous grass species.<br>• Re-vegetation efforts will be monitored every third month for a period of six months after initial seeding. | Rehabilitation to ensure that the area are vegetated with indigenous vegetation, clear of aliens and stable with no signs of erosion. | 15-17 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld pit | | | | | | | |
| | | Pit expansion | | | | | | | |
| | Biodiversity (fauna) | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD. | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of flora specimens due to clearing of areas for development, which includes protected and endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br>These areas are of value as they serve as links to allow the migration of fauna between areas on an ecosystem scale. | Control and prevent | • Impact area kept to the minimum.<br>• All impact areas must be demarcated.<br>• Any fauna directly threatened by the activities should be removed to a safe location by the environmental officer ("EO") or other suitably qualified person.<br>• The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.<br>• All staff and contractors should undergo an environmental induction course by the EO.<br>• Fires should only be allowed within fire-safe demarcated areas.<br>• No fuelwood collection should be allowed on-site.<br>• No dogs should be allowed on site.<br>• All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. | Prevent or minimise terrestrial biodiversity impact | 1-5 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion. | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld pit expansion | | Expanding the existing pit | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred) | Operation of Moolmans PCD | The transformation of extensive natural areas reduces landscape connectivity and loss of ecosystem functioning and services. Loss of flora specimens due to clearing of areas for development, which includes protected and | Control and prevent | • The EO should enforce any measures that he/she deem necessary to minimise destruction and damage to the environment and specifically areas outside of the footprint areas of the mining activities. | Prevent or minimise terrestrial biodiversity impact | 5-10 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 2 | Operation of the tyre storage area | endemic species. These areas are of value as they serve as links to allow the migration of fauna and flora between areas on an ecosystem scale.<br>These areas are of value as they serve as links to allow the migration of fauna between areas on an ecosystem scale. | | • Regular environmental training should be provided to construction workers to ensure the protection of the wetland habitat. Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Operation of the C&G stockpile | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld pit | | Expanding the existing pit | | | | | |
| | | Pit expansion | | Mining activities to enlarge the pit size | | | | | |
| | | Moolmans PCD | Alternative 1 (preferred) | Decommissioning and closure of the PCD | The removal of natural vegetation is regarded as a significant impact. However, should rehabilitation to as close as pre-mining conditions be undertaken appropriately and adequately, as well as the control of alien invasive species, a residual impact on vegetation may be prevented. Air pollution sources on site include land clearing activities, materials handling, wind erosion from disturbed areas and/or stockpiles, dust generated by vehicular movement along unpaved roads, and emissions from machinery and vehicles on site.<br>Air pollution from operational activities such as transportation of waste. The removal of topsoil may result in the mixing of the horizons of the soil that will have an impact on the fertility and production potential of the soil. | Control | • Wastes will be removed and disposed of at an appropriately licensed landfill (facility disposal licenses will be verified) and recyclables will be taken to a licensed recycling facility.<br>• Mechanical erosion control methods will be implemented if required. This may include the use of geotextiles.<br>• Re-vegetation will be conducted through hand seeding exposed areas using indigenous grass species.<br>• Re-vegetation efforts will be monitored every third month for a period of six months after initial seeding.<br>• An effective vegetation cover of 45% must be achieved. Re-seeding will be undertaken if this cover has not been achieved after six months. | Rehabilitation to ensure that the area are vegetated with indigenous vegetation, clear of aliens and stable with no signs of erosion. | 15-17 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Decommissioning and closure of the tyre area | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile | Alternative 1 (preferred) | Decommissioning and closure of the Lyleveld C&G stockpile | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld pit | | | | | | | |
| | | Pit expansion | | | | | | | |
| 7 | Sites of Archaeological and Cultural Importance | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | No impact on any heritage resources. | Avoid | No mitigation required. | Outcome:<br>To preserve the heritage of the area.<br>Standard:<br>Adherence to the requirements of the National Heritage Resources Act (No 25 of 1999. | Throughout the LOM |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | |
| | | | Alternative 2 | | | | | | |
| 8 | Palaeontological | Moolmans PCD | Alternative 1 (preferred) | Construction of Moolmans PCD | During the Impact Assessment, it was found that the Precambrian rocks of the Asbestos Hills Subgroup (Ghaap Group) of the Transvaal Supergroup are not known to host fossils. The overlying unconsolidated Tertiary-Quaternary sediments of the Kalahari Formation could potentially host fossils, but as these are unconsolidated deposits this is improbable. It is thus extremely unlikely that fossils will be found in the study area and be affected by the proposed expansion developments. | Control | If bedrock is exposed during excavations, a qualified specialist must be appointed to inspect excavations for the presence of fossils. If excavations will not expose bedrock, no further mitigation for paleontological heritage is recommended. | Outcome:<br>To preserve the palaeontology of the area.<br>Standard:<br>Adherence to the requirements of the National Heritage Resources Act (No 25 of 1999. | During construction phase |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | Construction of tyre expansion | | | | | |
| | | | Alternative 2 | | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | Construction of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit expansion | No alternatives | Expansion of the pit. | | | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| 9 | Sensitive landscapes (wetlands) | Lyleveld pit | Not applicable | Expanding of the pit | Pans identified in the area will not be impacted upon. | Control | • Ensuring that all stockpiled materials are stored at least 15 m away from aquatic ecosystems. The stockpile areas should not exceed 1.5 m in height and are covered (e.g. shade cloth) and thus protected from wind to prevent spread of fine material. Furthermore, these stockpile areas should be adequately bunded such that there is no runoff from these areas into freshwater ecosystems, particularly where the terrain is steep.<br>• Ensuring that washing and refuelling of vehicles and machinery take place well away from aquatic ecosystems (at least 15 m). All machinery should be regularly checked for leaks. Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.<br>• Ensure that no mixing of concrete should occur close to (less than 15 m away) from any aquatic ecosystems.<br>• The provision of adequate ablution facilities for construction workers to avoid contamination of aquatic ecosystems through human waste. These service areas must be maintained, and toilets emptied on at least a weekly basis. Furthermore, litter controls should be provided to prevent litter spreading across the site.<br>• Ensuring that any disturbance created through construction related activities is identified by the ECO and effectively remediated through rehabilitation of the habitat.<br>• Ensuring that pathways and access roads for construction avoid aquatic ecosystems, including their buffers.<br>• Ensuring that the edge of the aquatic ecosystems and their buffers be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction phase.<br>• Implementing sediment trapping mechanisms to prevent excessive erosion off the site as well as prevent siltation of the aquatic ecosystems on site, and downstream. This can be done by making use of sandbags before stabilising vegetation is established.<br>• It is recommended to install multiple culverts in the servitude road and in the haul roads to ensure effective drainage of surface runoff to the downstream environment. These culverts should be strategically placed in locations where runoff is likely to accumulate/concentrate. Erosion prevention measures (for example gabions) should be installed at all culverts due to the concentration of runoff in these locations. Regular inspections should be carried out to ensure the integrity of the culverts and to prevent blockages.<br>• It is further recommended that roads be managed in such a manner as to disperse runoff and to prevent the concentration of storm water flow. Storm water should be diverted from all roads using mitre drains and gaps in the roadside berms to disperse runoff and to prevent the concentrating of storm water flow. | Prevent or minimise aquatic biodiversity impact | 1-5 years |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Moolmans Maintenance Workshop | No alternatives | Construction of Moolmans Workshop | Loss of habitat.<br><br>Two small, interspersed pans were mapped west of the Moolmans maintenance workshop | Control and stop | • Assess alternative layouts to avoid destroying the pans.<br>• Designs for the pollution control dam must consider the 1:100-year floodline.<br>• All machinery should be regularly checked for leaks.<br>• Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.<br>• The provision of adequate ablution facilities for construction workers to avoid contamination of aquatic ecosystems through human waste. These service areas must be maintained, and toilets emptied on at least a weekly basis.<br>• Ensuring that any disturbance created through construction related activities is identified by the EO and effectively remediated through rehabilitation of the habitat.<br>• Ensuring that pathways and access roads for construction avoid aquatic ecosystems, including their buffers.<br>• Ensuring that the edge of the aquatic ecosystems and their buffers be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction phase.<br>• Implementing sediment trapping mechanisms to prevent excessive erosion off the site as well as prevent siltation of the aquatic ecosystems on site, and downstream. This can be done by making use of sandbags before stabilising vegetation is established.<br>• Maintain freeboard.<br>• It is recommended to install multiple culverts in the servitude road and in the haul roads to ensure effective drainage of surface runoff to the downstream environment. These culverts should be strategically placed in locations where runoff is likely to accumulate/concentrate.<br>• Footprint areas to be minimised to minimise the amount of run-off generated and the likelihood of the runoff containment infrastructure failing.<br>• Additional berms are to be constructed to prevent contaminated runoff from entering the sensitive areas and clean run-off is to be diverted away from.<br>• All machinery should be regularly checked for leaks.<br>• Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.<br>• Water Quality monitoring must be conducted in pans WT 1 to 4 when there is water in the pans.<br>• Implementing sediment trapping mechanisms to prevent excessive erosion off the site as well as prevent siltation of the aquatic ecosystems on site, and downstream. This can be done by making use of sandbags before stabilising vegetation is established.<br>• It is recommended to install multiple culverts in the servitude road and in the haul roads to ensure effective drainage of surface runoff to the downstream environment. These culverts should be strategically placed in locations where runoff is likely to accumulate/concentrate.<br>• Erosion prevention measures (for example gabions) should be installed at all culverts due to the | | |
| | | Moolmans Workshop haul road | Haul road alternative 1 | Construction of haul road for mining vehicles | Peripheral impacts to pans MW4 and MW5. | Control and stop | | | |
| | | | Haul road alternative 2 | | | | | | |
| | | Tyre expansion area | Alternative 1 (preferred) | Construction of tyre expansion | Loss of habitat.<br><br>Four small, interspersed pans were mapped west and south of the Tyre yard. | Control and stop | | | |
| | | | Alternative 2 | | | | | | |
| | | Moolmans pollution control dam | Alternative 1 (preferred) | Operation of Moolmans PCD | | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Lylyveld C & G stockpiles and backfilled area | Alternative 1 (preferred) | Operation of Lyleveld C&G stockpile and the backfill of Lyleveld existing pit. | | Control | | | |
| | | | Alternative 2 | | | | | | |
| | | Pit Expansion | No alternatives | Operation of the expanded pit | | | | | |
| | | | | | Six pans on the western edge of the pit expansion area as Freshwater Ecosystem Priority Area (FEPA) and Freshwater Ecological features are inside or close to the study area. | Control | | | |
| | | Moolmans Maintenance Workshop | No alternatives | Decommissioning and closure of the Moolmans Workshop | Two small, interspersed pans were mapped west of the Moolmans maintenance workshop | Control | | | |
| | | Tyre expansion area | Alternative 1 (preferred) | Four small, interspersed pans were mapped west and south of the Tyre yard. | Four small, interspersed pans were mapped west and south of the Tyre yard. | Control and prevent | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 2 | | | | concentration of runoff in these locations. Regular inspections should be carried out to ensure the integrity of the culverts and to prevent blockages.<br>• It is further recommended that roads be managed in such a manner as to disperse runoff and to prevent the concentration of storm water flow. Storm water should be diverted from all roads through the use of mitre drains and gaps in the roadside berms to disperse runoff and to prevent the concentrating of storm water flow. | | |
| 10 | Air quality | Ore stockpile | Alternative 1 (preferred)<br>Alternative 2 | Windblown dust from waste dumps, haul roads, blasting activities and materials handling | Impact on the ambient air quality | Control through mine planning (watering and chemically treating roads, rock cladding or vegetation on waste dumps). | Watering and chemical treatment of haul roads. Rock cladding and/or vegetation of waste dumps. Reduce tipping height to stockpiles. | Outcome:<br>To reduce the impact on the ambient air quality.<br>Standard:<br>National Ambient Air Quality Standards (NAAQS). | During the Operational Phase, until cessation of mining activities. |
| 11 | Noise | Activities associated with the development of the Moolman Maintenance Workshop | Alternative 1 (preferred)<br>Alternative 2 | The activities may raise ambient sound levels at the closest NSR. | The activities may raise ambient sound levels at the closest Noise-Sensitive Receptor ("NSR"). | None required | No mitigation measures proposed. | Outcome:<br>Night-time noise limit of 45 dBA.<br>Standard:<br>NCR (GN R154 of 1992), WHO and IFC Noise Limits. | Before the implementation of the project. |
| | | Activities associated with the development of the Tyre Storage Yard (valid for both alternatives) | Alternative 1 (preferred)<br>Alternative 2 | The activities may raise ambient sound levels at the closest NSR. | | | No mitigation measures proposed. | | |
| | | Activities associated with the development of the Expansion Project as well as associated infrastructure (valid for all alternatives) | Alternative 1 (preferred)<br>Alternative 2 | The activities may raise ambient sound levels at the closest NSR at night. | | Control | NSR staying at NSR05 to be relocated before mining activities start in area. | | |
| | | Activities associated with increasing of pit, backfilling activities and construction and operation of stockpile (valid for both alternatives) | Alternative 1 (preferred)<br>Alternative 2 | The activities may raise ambient sound levels at the closest NSR. | | None required | No mitigation measures proposed. | | |
| 12 | Visual | Pit expansion including PB 19, C&G Stockpile alternatives | Relevant to both alternatives | Site clearing of the project footprint areas associated with the proposed expansion area, including the stockpiles, roads etc. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning | • The development footprints and disturbed areas should be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum.<br>• As far as possible, existing roads should be used, to avoid excess removal of vegetation for additional haul roads.<br>• The extent of all surface infrastructure footprint areas and permanent structures must be minimised to what is absolutely essential.<br>• It must be ensured that existing vegetation in the vicinity of the proposed expansion area and along the roads are retained during the construction phase to act as visual screens from surrounding receptor sites. | Outcome:<br>Minimise the visual impact to surrounding receptors.<br><br>Standard:<br>Rehabilitation standards In compliance with the Mining Rights issued in terms of the MPRDA (2002), and the approved EMPr | During the construction phase, until cessation of mining activities |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | • Placement of infrastructure outside of the ecologically sensitive areas that also act as visual resources.<br>• Care to be taken during construction to limit alteration of sensitive areas as far as possible.<br>• Appropriate rehabilitation actions to be taken where damage to natural visual resources has taken place. | | |
| | | | | Construction of the stockpiles, roads etc.; | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | To minimise the visual impact from excavations | • Excavation is to be kept to a minimum and limited to essential areas.<br>• The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint.<br>• It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation;<br>• It must be ensured that all buildings and other built structures fit its surroundings through the appropriate use of colour and material selection in order to lower the visibility of the proposed project.<br>• Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings.<br>• During rehabilitation, the removal of infrastructure and ripping and reshaping of impacted areas should take place. | | During the construction phase, until cessation of mining activities |
| | | | | | Topographical alteration as a result of construction activities such as the stockpiles that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region. | To shape the stockpiles in a more natural manner that blends in with the landscape | • The height of the stockpiles should as far as possible not exceed that of the existing adjacent mine dumps, nor that of the proposed design;<br>• It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive receptors;<br>• During rehabilitation, it should be ensured that alien vegetation proliferation on the stockpiles be mitigated and managed and should it be deemed feasible the stockpiles be hydroseeded with indigenous vegetation, to blend in with the surrounding area over time, once vegetation growth has been established. | | |
| | | | | Dumping of waste material at the stockpiles;<br>Dust generation especially on a windy day from dumping of waste material. | Continual dumping of material and increasing heights of the stockpiles during operational activities. | To limit visual impacts as a result of dumping of material at the stockpiles | • The design and height increase of the stockpiles must be monitored to ensure that these components relate to acceptable environmental standards in terms of slope and elevation.<br>• The stockpiles is ideally to be shaped at an adequate slope from the commencement of the project to ensure that it integrates more successfully into the natural topography of the visual landscape.<br>• The stockpiles must be shaped and rounded to blend in with the surrounding dumps and to minimise visual contrast and an angular skyline. | | During operational phase |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mine vehicles driving on haul roads and dumping of waste material on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors. | To limit impacts on the visual environment from haziness caused by dust | • It is recommended that internal roads should be surfaced to minimise dust.<br>• All dirt and temporary access roads will require dust suppression such as regular watering.<br>• The stockpiles prone to dust generation must be kept damp during the dry season, and preferably be vegetated in order to minimise the potential for dust generation.<br>• Access roads must be suitably maintained to limit erosion and dust pollution.<br>• Vehicle speed on unpaved roads must be reduced to limit dust generation.<br>• It must be ensured, where possible, that existing natural vegetation is to be retained and incorporated into the design, especially within the line of sight from visual receptors. | | |
| | | PB 19, C&G Stockpile alternatives. | Relevant to both alternatives | Night time lighting associated with the proposed far south substation and PB 19. | No backfilling into PB 19 remaining, partially altering the skyline. | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | PB 19 remaining there are limited mitigation measures that will reduce the impact significance therefore visual scarring will remain. | | |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | • Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose.<br>• All areas where infrastructure is removed must be resloped to resemble the pre-development landscape as far as possible, and revegetated as soon as possible. | | |
| | | | | Rehabilitation activities. | Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | | • Rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas.<br>• Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration in order to cover bare areas and prevent soil erosion.<br>• Upon final rehabilitation, it must be aimed to remove as much surface infrastructure, including berms and to reshape the landscape to pre-development conditions | | |
| | | Proposed C&G Stockpile areas associated with the Lylyveld pit. | | Site clearing of the project footprint areas associated with the proposed stockpiles and proposed Lylyveld opencast pit. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning | • The development footprints and disturbed areas should be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum.<br>• As far as possible, existing roads should be used, to avoid excess removal of vegetation for additional haul roads.<br>• The extent of all surface infrastructure footprint areas and permanent structures must be minimised to what is absolutely essential.<br>• It must be ensured that existing vegetation in the vicinity of the proposed expansion area and along the roads are retained during the construction phase to act as visual screens from surrounding receptor sites. | | During the construction phase, until cessation of mining activities |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | • Placement of infrastructure outside of the ecologically sensitive areas that also act as visual resources.<br>• Care to be taken during construction to limit alteration of sensitive areas as far as possible<br>• Appropriate rehabilitation actions to be taken where damage to natural visual resources has taken place. | | |
| | | | | Construction of the stockpiles | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | To minimise the visual impact from excavations | • Excavation is to be kept to a minimum and limited to essential areas.<br>• The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint.<br>• It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation;<br>• It must be ensured that all buildings and other built structures fit its surroundings through the appropriate use of colour and material selection in order to lower the visibility of the proposed project.<br>• Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings.<br>• During rehabilitation, the removal of infrastructure and ripping and reshaping of impacted areas should take place. | | During the construction phase, until cessation of mining activities |
| | | | | | Topographical alteration as a result of construction activities such as the stockpiles that will be silhouetted in the skyline, leading to a change in the natural environment which will lead to increased level of visual intrusion and a potential impact on sense of place of the region. | To shape the stockpiles in a more natural manner that blends in with the landscape | • The height of the stockpiles should as far as possible not exceed that of the existing adjacent mine dumps, nor that of the proposed design;<br>• It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive receptors<br>• During rehabilitation, it should be ensured that alien vegetation proliferation on the and stockpiles be mitigated and managed and should it be deemed feasible the stockpiles be hydroseeded with indigenous vegetation, to blend in with the surrounding area over time, once vegetation growth has been established. | | |
| | | | | Dumping of waste material at the stockpiles;<br>Dust generation especially on a windy day from dumping of waste material. | Continual dumping of material and increasing heights of the stockpiles during operational activities. | To limit visual impacts as a result of dumping of material at the stockpiles. | • The design and height increase of the stockpiles must be monitored to ensure that these components relate to acceptable environmental standards in terms of slope and elevation.<br>• The stockpiles is ideally to be shaped at an adequate slope from the commencement of the project to ensure that it integrates more successfully into the natural topography of the visual landscape.<br>• The stockpiles must be shaped and rounded to blend in with the surrounding dumps and to minimise visual contrast and an angular skyline. | | During operational phase |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mine vehicles driving on haul roads and dumping of waste material on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors. | To limit impacts on the visual environment from haziness caused by dust | • It is recommended that internal roads should be surfaced to minimise dust.<br>• All dirt and temporary access roads will require dust suppression such as regular watering.<br>• The stockpiles prone to dust generation must be kept damp during the dry season, and preferably be vegetated in order to minimise the potential for dust generation.<br>• Access roads must be suitably maintained to limit erosion and dust pollution.<br>• Vehicle speed on unpaved roads must be reduced to limit dust generation.<br>• It must be ensured, where possible, that existing natural vegetation is to be retained and incorporated into the design, especially within the line of sight from visual receptors. | | |
| | | Proposed C&G Stockpile areas associated with the Lyleveld pit. | Relevant to both alternatives | | | | • It is suggested that a lighting engineer be consulted to assist in the planning and placement of light fixtures for the Lylyveld opencast pit in order to reduce visual impacts associated with glare and light trespass.<br>• As far as possible, operational activities should take place during the daylight hours, in order to limit the use of bright floodlighting and to avoid the use of additional night-time lighting which may lead to skyglow.<br>• Outdoor lighting must be strictly controlled.<br>• The use of high light masts and high pole top security lighting should be avoided along the periphery of the operations. Any high lighting masts should be covered to reduce sky glow.<br>• Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, in so doing minimising the light spill and trespass. | | |
| | | | | Night time lighting associated with the Lylyveld opencast pit | Night time lighting due to 24 hour operations of the HME Parkup, substation and PB Pits 19 and 21 potentially impacting on receptors. | To limit visual impacts from night time lighting | • Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only “full cut-off” light fixtures that direct light only below the horizontal must be used on the building.<br>• Censored and motion lighting may be installed to prevent use of lights when not needed.<br>• Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose.<br>• Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013)<br>• The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013) | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Backfilling of the Lylyveld existing opencast pit | Backfilling into the Lylyveld existing opencast pit, altering the skyline, may be a net postie impact. | Backfilling of the Lylyveld open cast pit may be a low positive impact, if it is rehabilitated well, possibly resulting in no visual scarring | The open pits must be backfilled, shaped and revegetated to resemble the surrounding landscape as far as is feasible. | | During Decommissioning and Closure Phase |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | To limit visual impacts as a result of mine surface infrastructure decommissioning | • Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose.<br>• All areas where infrastructure is removed must be resloped to resemble the conditions that, as far as possible, mimic the natural landscape and revegetated as soon as possible. | | |
| | | | | Rehabilitation activities. | Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | • Rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas.<br>• Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration to cover bare areas and prevent soil erosion.<br>• Upon final rehabilitation, it must be aimed to remove as much surface infrastructure, including berms and to reshape the landscape to pre conditions that, as far as possible, mimic the natural landscape. | | |
| | | Tyre storage yards | | Site clearing of the project footprint areas associated with the tyre storage yards. | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning | • The development footprints and disturbed areas should be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum;<br>• The vegetation removal associated with the fire-break around the tyre storage yard should be kept to minimum ;<br>• A transparent fence, such as a clearVU fence or similar, should be muted in colour and located as close as possible around the tyre storage yard, to avoid impeding visibility and ensure that it is visually pleasing to observers; | | During the construction phase, until cessation of mining activities |
| | | | | Construction of the tyre storage yards | Placement of gravel within the tyre storage yard and the fence on the periphery | | | | |
| | | | | Placement of used tyres and potentially increasing the height of the tyre piles<br>Dust generation from the gravel | Continual placement of used tyres and potentially increasing the height of the tyre piles | To limit visual impacts | • The height of the tyre stockpiles should not exceed that of the existing tyre storage yard;<br>• The gravel surface will require dust suppression such as regular watering. | | During operational phase |
| | | | | | Mine vehicles dumping tyres on a windy day could lead to temporary atmospheric haziness, which is likely to lead to visual impacts on adjacent receptors. | To limit impacts on the visual environment from haziness caused by dust | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Night time lighting associated with the proposed tyre storage yard | Night time lighting due to 24 hour operations of tyre storage yard | To limit visual impacts from night time lighting | • lighting engineer may be consulted to assist in the planning and placement of light fixtures for the tyre storage yard in order to reduce visual impacts associated with glare and light trespass.<br>• As far as possible, activities should take place during the daylight hours, in order to limit the use of additional night-time lighting which may lead to skyglow.<br>• Outdoor lighting must be strictly controlled.<br>• The use of high light masts and high pole top security lighting should be avoided along the periphery of the operations. Any high lighting masts should be covered to reduce sky glow.<br>• Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, in so doing minimising the light spill and trespass.<br>• Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only “full cut-off” light fixtures that direct light only below the horizontal must be used on the building.<br>• Motion sensing lighting technology may be installed to prevent use of lights when not needed.<br>• Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose.<br>• Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013)<br>• The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013) | | |
| | | | | Demolition of tyre storage area | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors | To limit visual impacts | • Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose.<br>• All areas where infrastructure is removed must be resloped to resemble the conditions that, as far as possible, mimic the natural landscape, and revegetated as soon as possible.<br>• Rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas.<br>• Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration in order to cover bare areas and prevent soil erosion.<br>• Upon final rehabilitation, it must be aimed to remove as much surface infrastructure, including berms and to reshape the landscape to conditions that, as far as possible, mimic the natural landscape | | During Decommissioning and Closure Phase |
| | | | | Rehabilitation activities. | Potential ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | Moolmans Workshop facilities and associated PCDs | | Site clearing of the project footprint areas associated with the proposed expansion area, including the PCDs and the Moolmans Workshop facilities | Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. | To keep development footprint area as small as possible in order to prevent unnecessary loss of vegetation, control through planning. | • The development footprint and disturbed areas should be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum;<br>• All construction areas must be kept in a neat and orderly condition at all times;<br>• The colour palette of the proposed buildings should match the neutral colours of the existing buildings, so as to blend in with the existing buildings;<br>• Vehicle speed on gravel roads must be reduced to limit dust creation;<br>• The use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings. The identification of appropriate colours and textures for facility materials should take into account both summer and winter appearance;<br>• Excavation is to be kept to a minimum and limited to essential areas; | | During the construction phase, until cessation of mining activities |
| | | | | | Alteration of natural features as a result of infrastructure placement and positioning, including potential loss or alterations of natural vegetation, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. | To prevent loss of habitat features that act as visual resources within the area and contribute to landscape character | | | |
| | | | | Construction of the Moolmans Workshop facilities and PCDs | Excavation during construction of proposed infrastructure will lead to visual intrusion and visual exposure. | To minimise the visual impact from excavations | | | |
| | | | | Operation of the Moolmans Workshop Facility | Continual movement of mine workers in the area | To limit visual impacts as a result of dumping of material at the stockpiles | A lighting engineer may be consulted to assist in the planning and placement of light fixtures for the Moolmans Workshop Facility in order to reduce visual impacts associated with glare and light trespass. | | During operational phase |
| | | Moolmans Workshop facilities and associated PCDs | | Night time lighting associated with the proposed Moolmans Workshop Facility | Night time lighting due to 24 hour operations of the HME Moolmans Workshop Facility potentially impacting on receptors. | To limit visual impacts from night time lighting | • As far as possible, activities should take place during the daylight hours, to limit the use of additional night-time lighting which may lead to skyglow.<br>• Outdoor lighting must be strictly controlled.<br>• The use of high light masts and high pole top security lighting should be avoided along the periphery of the operations. Any high lighting masts should be covered to reduce sky glow. | | During Decommissioning and Closure Phase |
| | | | | Demolition of all surface infrastructure | Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. | To limit visual impacts as a result of mine surface infrastructure decommissioning | | | |

| No. | Aspect affected | Alternatives | Alternative description | Activity | Potential Impact | Mitigation Type | Impact management actions / Mitigation measures | Impact management outcome/ Standard to be achieved | Time period for implementation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Rehabilitation activities. | Potential ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region. | To ensure that effective rehabilitation takes place in such a way as to prevent permanent visual impacts remaining post-closure | • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, in so doing minimising the light spill and trespass.<br>• Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only "full cut-off" light fixtures that direct light only below the horizontal must be used on the building.<br>• Motion sensing lighting solutions may be installed to prevent use of lights when not needed.<br>• Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose.<br>• Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013)<br>• The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013)<br>• Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose.<br>• All areas where infrastructure is removed must be resloped to resemble the pre-development landscape as far as possible, and revegetated as soon as possible.<br>• Rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas.<br>• Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration in order to cover bare areas and prevent soil erosion.<br>• Upon final rehabilitation, it must be aimed to remove as much surface infrastructure, including berms and to reshape the landscape to conditions that, as far as possible, mimic the natural landscape | | |
| 13 | Socio-economic | Moolmans PCD | Alternative 1 (preferred) | Construction, and operation, of the Sishen Expansion project. | Jobs will be retained, and additional jobs created providing income and, therefore, having a further positive impact on the regional socio-economy aspects of the area, along with other benefits arising from the Social and Labour Plan. | Control | • Ensure a transparent employment system is in place.<br>• The beneficiaries of local economic opportunities must as far as possible be from the local community.<br>• Develop a recruitment policy that allows equal opportunity to all people (woman, disabled) and give preference to local labour.<br>• A complaints register should be kept, and the following should be recorded, investigated and feedback provided to complainants:<br>○ Name and surname of complainant,<br>○ Contact details of complainant,<br>○ Date of complaint,<br>○ Person or department responsible for complaint,<br>○ Actions for implementation (if any),<br>○ Date of implementation,<br>○ Date of feedback provided to complainant, and<br>○ Indication if complaint is closed or open. | Outcome:<br>To maximise economic opportunities for local employment and development.<br>Standard:<br>Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002).<br>Social and Labour Plan. | 1-17 years |
| | | | Alternative 2 | | | | | | |
| | | Tyre expansion | Alternative 1 (preferred) | | | | | | |
| | | | Alternative 2 | | | | | | |
| | | Lyleveld C&G stockpile and backfill | Alternative 1 (preferred) | | | | | | |
| | | | Alternative 2 | | | | | | |

## 1.5 Closure objectives and financial provision

### 1.5.1 Closure objectives (EIAR/EMPr 2017)

The following information was obtained from the report *Anglo American: Kumba Iron Ore - Sishen Mine: Preliminary Closure Plan*, dated 2017 and compiled by Shangoni Management services (Pty) Ltd.

The overarching goals for closure are described below, and give effect to physical, biophysical, and social closure objectives tabled below in Table 25:

- A walk-away closure with limited / no significant long-term liabilities that require management;
- Rehabilitation is of high quality and sustainable into the predictable future;
- Proposed post-closure land uses are sustainable;
- Stakeholder engagement is undertaken, and their views have been considered in closure planning;
- Permanent SIOM employees have been successfully redeployed or re-skilled;
- Legal compliance has been achieved;
- Authorities will be satisfied with the extent of rehabilitation and closure criteria; and
- The DMR will be satisfied to issue a closure certificate with limited / no significant conditions attached.

From the overarching goals the following objectives are applicable to SIOM:

*Table 25: Detailed Closure Objectives (Preliminary Closure Plan)*

| Physical Objectives | Biophysical Objectives | Social objectives |
|---|---|---|
| All the rehabilitated land is safe and useable, excluding the open pits and potentially the pit-facing slopes of the WWRD 5, which will be wilderness. | Minimise all negative impacts on the bio-physical environment as far as possible. | Ensure that issues will be addressed and managed so that the main objective and acceptable closure plan can be attained. |
| All rubble from plant decommissioning and related areas do not cause long term degradation or become a safety hazard. | Those rehabilitated areas can be utilised in a sustainable manner. | Stakeholder engagement is undertaken, and their views must be considered during closure planning. |
| All waste dumps be closed and rehabilitated as per the legislative framework. | Ground- and surface water will not be polluted once the mine is closed. (e.g., slimes dams); | Permanent employees will be re-deployed and re-skilled to minimise job losses as far as possible. |
| Land be physically and chemical stable. | To ensure legal compliance in terms of biophysical closure. | To stimulate the economy of the area by implementing viable projects that will enable some of the employees to be redeployed within that sector. |
| The safety zone of the open pit is established, and suitable measures taken to prohibit access. | | That rehabilitation work as well as other related work with regards to closure is not outsourced but that ex-employees can form part of this process, as far as possible, ensuring job continuation after closure. |
| | | That mine owned houses are sold to individuals. |
| | | Those employees are generally satisfied with re-deployment, re-skilling, and alternative employment opportunities. |

### 1.5.2 Closure objectives (EMPr 2002)

The following information was obtained from the Sishen Iron Ore Mine Environmental Management Programme Report, July 2002.

*Table 26: 2002 closure objectives*

| Element | Summary of impact assessment | Closure objective |
|---|---|---|
| A6.2.1 Geology | The geology at the Sishen Iron Ore Mine has been highly impacted upon due to blasting, excavation and the removal of iron ore. | No mitigation is achievable. |
| A6.2.2 Topography - Waste dumps | The deposition of waste rock has impacted on the topography of the area. | All mine infrastructures will be removed at closure, and disturbed areas rehabilitated. All residue deposits at closure will be sloped to 18° and rehabilitated. If experimentation undertaken by the mine is able to successfully rehabilitate the residue deposits at steeper angles and agreed to by the DME, then the recommendations of the experimentations will be implemented. |
| A6.2.3 Soils | Shallow (15cm average) soils of the area have been disturbed by mining activities, which invariably leads to some topsoil loss. | Growth medium will be placed on all disturbed areas. Actual medium to be used and depths of cover is still to be determined experimentally by 2006. |
| 6.2.4 Land capability | Land capability has been impacted upon by the deposition of the waste rock dumps, slimes dams and by general mining operations | All disturbed areas will be rehabilitated to accommodate small livestock farming, except for the remaining open pit. |
| A6.2.5 Land use | Change of land use from small-scale livestock farming to mining. | Land use will be reverted back to small-scale livestock farming by ±2030. |
| A6.2.6 Natural vegetation | The natural vegetation at the site has been negatively impacted upon in the mining area. | Naturally occurring (indigenous) species will be used in the re-vegetation of disturbed areas. Optimal crown and basal cover of disturbed areas will be determined experimentally in conjunction with DME. |
| A6.2.8 Surface water | The post closure impacts on surface water will be related to the reduction in catchments yield as a result of evaporation from the open pits. | A storm water drainage system will be implemented to mimic the natural drainage direction. All surface sources of potential pollution will be removed. Water use charges will be negotiated with DWAF. |
| A6.2.9 Ground water | Mining has impacted on the ground water levels as a consequence of the dewatering program and excavation of the pit. In isolated areas the water quality has been impacted by organic and inorganic contamination. | Post operational ground water levels have been modelled, and are expected to return to 30m below the original surface elevation (see figure 5.4.2 A-D). Nitrate concentrations in the groundwater will be kept to within the legal limits for potable water. Sources of organic pollution will be removed. All groundwater extraction infrastructures will be handed over to DWAF as per current permit stipulation. |
| A6.2.10 Air quality | The air quality at the mine has been impacted upon by dust. | Disturbed areas will be covered with a growth medium and re-vegetated. An exact objective (tons per annum) for the amount of dust export will only be available in December 2003. |
| A6.2.11 Noise | Noise impact generated by mining is confined to within the mining operation. | Noise levels at closure will be limited to DWAF pumping scheme and other small scale industries that form part of the mines social investment initiatives. |
| A6.2.12 Sensitive landscapes | Several sensitive landscapes exist on the mine property. | Sensitive landscapes will only be mined with the permission of the relevant authorities. Any closure requirements will be adhered to. |
| A6.2.13 Visual aspects | The visual landscape at Sishen has been impacted upon by mining | Refer to the section on topography. A detailed visual impact assessment is |

| Element | Summary of impact assessment | Closure objective |
|---|---|---|
| | operations. This includes the waste rock dumps, slimes dams, tailings dumps and excavations. | being carried out, which will determine if any further mitigation is necessary, the survey is to be completed by October 2003. |
| A6.2.14 Regional socio-economic structure | The mine has had a large positive impact on the regional socio-economic structure. About 3 200 people are employed by the mine, and most of the retail outlets in Kathu are dependent on the mine. The mine also provided the infrastructure and water supply at Kathu, Sesheng and Dingleton. | The mine is currently busy with a number of long-term sustainable development programs (see Appendix 25 Social responsibility report). |

## 1.6 Mechanisms for monitoring compliance

The aim of environmental monitoring and auditing is to develop a cost-effective approach to monitoring the operations' environmental performance. Certain parameters (e.g., water quality) can be monitored through measurements, others can only be monitored through observation (e.g., maintenance effectiveness). However, in all cases anticipation of environmental problems through assessment of the environmental impact of the operations' working methods, followed by forward planning to prevent problems or at least limit their effects, is the key to successful environmental management.

Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including.

- Monitoring of impact management actions;
- Monitoring and reporting frequency;
- Responsible persons;
- Time period for implementing impact management actions; and
- Mechanism for monitoring compliance

*Table 27: Impacts monitoring programme as applicable to the Sishen Expansion Project*

| NO | SOURCE ACTIVITY | IMPACTS REQUIRING MONITORING PROGRAMMES | FUNCTIONAL REQUIREMENTS FOR MONITORING | ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES) | MONITORING AND REPORTING FREQUENCY |
|---|---|---|---|---|---|
| 1 | EIAR/EMPr compliance (external) | Auditing of environmental authorisation, environmental management programme and closure plan must be done in accordance with the Regulation 34 and Appendix 7 of the EIA Regulations (2014) under the NEMA (1998). EIAR/EMPr audits shall be in accordance with the period specified in the approved EMPr, every 2 years or as agreed in writing by the Minister. The audits will be undertaken by an independent third party. | A formal Audit Report will be submitted to the DMRE biennially. | Environmental Department | Every second year |
| 2 | EIAR/EMPr compliance (internal) | Compliance with the approved EIAR/EMPr will be audited internally by the Environmental Manager on an annual basis.<br>Ad-hoc audits will be undertaken by the Environmental Department. | Records of internal audits will be retained. | Environmental Department | Annually |

| NO | SOURCE ACTIVITY | IMPACTS REQUIRING MONITORING PROGRAMMES | FUNCTIONAL REQUIREMENTS FOR MONITORING | ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES) | MONITORING AND REPORTING FREQUENCY |
|---|---|---|---|---|---|
| 3 | Water quantity & quality monitoring | Monitoring of surface and ground water resources will take place according to the IWUL. The mine's water quality monitoring is conducted by an external consultant. | Water quantity & quality monitoring results will be reported to DWS as per the IWUL requirements. These results will be reported to DMRE on an annual basis. | Environmental Department | As per the Integrated water use licence ("IWUL") |
| 4 | Environmental noise monitoring | An environmental baseline noise survey will be undertaken on an annual basis at sensitive noise receptor areas around the mine, or alternatively, when new expansion projects are planned. The annually noise survey will be undertaken by an external consultant. | Noise baseline survey to be submitted to DMRE on annual basis. | Environmental Department | Annually |
| 5 | Vibration and air blast monitoring | The vibration and air blast arising from all blasts at SIOM is monitored by an external consultant. | Blast and air blast data will be reported to DMRE on an annual basis | Mining Department | Annually |
| 6 | Rehabilitation progress monitoring | Rehabilitation will be undertaken in accordance with the mine's 5-Year Rehabilitation Plan. | Progress made with the implementation of the 5-Year Rehabilitation Plan will be reported to DMRE on an annual basis | Environmental Department | Every 5 years |
| 7 | Air Quality Monitoring | The mine's air quality monitoring program comprises of PM10, PM2.5 and dust fallout monitoring. PM10, PM2.5 monitoring is by means of permanently mounted particulate monitors that sends data to an online database. | Air quality monitoring results will be reported to DAFF on an annual basis. | Environmental Department | Annually |

| NO | SOURCE ACTIVITY | IMPACTS REQUIRING MONITORING PROGRAMMES | FUNCTIONAL REQUIREMENTS FOR MONITORING | ROLES AND RESPONSIBILITIES (FOR THE EXECUTION OF THE MONITORING PROGRAMMES) | MONITORING AND REPORTING FREQUENCY |
|---|---|---|---|---|---|
| 8 | Biodiversity Monitoring | Biodiversity monitoring will be undertaken according to the biomonitoring protocol. Biodiversity monitoring will be undertaken jointly by the mine and external consultants when possible.. | Biodiversity monitoring results will be reported to DMRE on an annual basis. | Environmental Department | Annually |
| 9 | Topsoil monitoring | The volumes of topsoil removed, stockpiled, and used for rehabilitation will be recorded. | Topsoil volumes will be reported to DMRE on an annual basis. | Environmental Department | Annually |
| 10 | Contaminated soil monitoring | The volumes of contaminated soil generated, stockpiled, treated, disposed, etc. will be recorded. | Contaminated soil volumes will be reported to DMRE on an annual basis. | Environmental Department | Annually |
| 11 | Legal compliance audits (external) | An external legal compliance audit (environmental) will be undertaken by an independent third party on an annual basis. | Records of external legal audits will be retained at the mine. | Environmental Department | Annually |
| 12 | IWUL performance audit (external) | An external IWUL performance audit will be undertaken by an independent third party on an annual basis | The outcomes of the IWUL performance audit will be submitted to DWS on an annual basis. | Environmental Department | Annually |
| 13 | Pans | According to the *Aquatic Biodiversity Impact Assessment – Sishen Iron Ore Mine Expansion Project Application*, dated September 2023 and prepared by Enviro-EAP water quality monitoring must be conducted in pans MW 1 and MW 4 when there is water in the pans. | To be submitted to DWS | Environmental Department | When there is water in the pans |

## 1.7 Programme for reporting on compliance

Unless otherwise instructed by the Competent Authority (in this case, the DMRE) or as a condition to the EA, environmental compliance audits on the EMPr will be undertaken biennially, and the resultant audit reports will be submitted to the DMRE. The auditing process, as well as report format will comply with the requirements as contained in the EIA Regulations, GN R982, dated December 2014, as amended.

## 1.8 Environmental awareness plan

SIOM developed and implemented an Environmental Management System ("EMS") that complies with the requirements of ISO14001:2004 Environmental Management Systems and is certified by the South African Bureau of Standards. Surveillance audits are conducted annually, and recertification audits every third year. The mine's EMS addresses the following elements of the ISO14001 standard and these, in conjunction with the environmental commitments, ensure that potential environmental impacts arising from the mine's activities are managed appropriately:

- An environmental policy that includes commitments to prevent pollution, comply with applicable legal requirements and provides a framework for setting environmental objectives and targets.
- A register of environmental aspects and impacts with a view to implementing operational control measures to limit environmental impacts.
- A register of all applicable legal requirements to ensure legal compliance.
- A register of environmental objectives and targets that is consistent with the environmental policy and considers significant environmental impact and the management thereof, together with a program for achieving the identified objectives and targets.
- Resources to ensure implementation of the EMS.
- An environmental training and awareness program to ensure that persons performing tasks that could cause significant environmental impacts are aware of such impacts and are competent to perform such tasks.
- A communication procedure for internal and external communication in respect of significant environmental aspects.
- All Environmental Management System Documentation, as required by the ISO14001 standard, which includes control procedures for documents and records.
- Operational control procedures for activities that could cause significant environmental impact to ensure that correct procedures are implemented to minimise potential environmental impacts.
- An emergency preparedness and response procedure that identifies potential emergency situations and potential accidents that can impact on the environment to ensure that such situations are dealt with in an appropriate manner.
- An environmental monitoring and measurement program to monitor and measure the key characteristics of the operation that can cause significant environmental impact and to gauge the success of implemented mitigation measures.

- A procedure for periodically evaluating compliance with applicable legal requirements.
- A procedure for dealing with non-conformities in terms of their identification, corrective action, and preventative action.
- Audit programs and procedures that makes provision for internal and external audits focussing on implementation of the requirements of the EMS and legal requirements.
- Management reviews undertaken at planned intervals to ensure the system's continuing suitability, adequacy, and effectiveness.

Within the context of the principles listed above, the long-term sustainability objectives of the mine are:

- To avoid impacts by effective planning to prevent and limit possible impacts.
- To minimise impacts by implementing decisions or activities that are designed to reduce the undesirable impact on the bio-physical and socio-economic aspects detailed in the previous sections.
- Rectifying impacts by rehabilitating or restoring, where applicable, the affected environment. This will include attempts at habitat re-creation and restoring the land to the natural pre-mining land uses or to a pre-determine and approved land use.

Some of the EMS elements listed above are described in the sections below.

### 1.8.1 Environmental awareness and training program

SIOM has established a program for SHEQ competence, training, and awareness. The procedure is revised from time-to-time as deemed appropriate by the mine. Environmental awareness training at SIOM takes place in accordance with this procedure. Three levels of training have been identified in the procedure, namely general awareness training, job specific training and competency training. All employees receive SHEQ (Safety, Health, Environmental and Quality) awareness training through the mine's e-learning system. Training for specific operations is based on the risk-based needs of a specific section and environmental awareness modules are used for this purpose. The mine also conducts training during the shift training sessions and monthly environmental topics are circulated through the mine's communication systems.

### 1.8.2 Public engagement strategy

Public engagement will take place by means of Sishen Public Engagement Forum ("PEF") meetings to be facilitated each year. The information sharing at the proposed PEF will be more generic with information sharing. As a guideline, the following aspects will be considered for discussion at the PEF:

- Production achieved at the mine;
- Initiatives undertaken to mitigate its environmental impacts;
- Any authority site visits undertaken or a description of instances where positive interaction occurred with the authorities;
- A general description of new projects especially focusing on environmental improvements; and
- Assurance that the complaints system is operational and report back on matters resolved.

SIOM will engage with selected community stakeholders and farmers on environmental management issues and complaints. Such engagement will be undertaken by invitation. SIOM has a stakeholder manager working specifically with the farmers and this channel serves as further means for farmers to engage with the mine.

Complaints received from the public will be dealt with in accordance with SIOM's complaints procedure.

### 1.8.3 Emergency preparedness and response

SIOM has established an emergency preparedness and response procedure that sets out roles & responsibilities and the action to be taken in the event of different types of emergencies. These include power failures, fires, flooding, major chemical / hydrocarbon spills, dam wall failures and various others. The procedure is revised from time-to-time as deemed appropriate by the mine. All emergencies at SIOM are dealt with in terms of this procedure.

### 1.8.4 Environmental monitoring, measurement, auditing, and reporting

Refer to Section 1.7 of Part B above.

### 1.8.5 Non-conformities and corrective action

SIOM has an established procedure for dealing with accidents and non-conformances. The procedure requires that any person who detects any non-conformities in their work area, should report this on the mine's incident reporting system.

Following the reporting of an incident, it is investigated, and corrective measures implemented to prevent re-occurrences.

## 1.9 Specific information required by the Competent Authority

The information, as presented in Table 28 below, will be required by the competent authority.

*Table 28: Monitoring information required by the competent authority*

| Information | Frequency of submission |
|---|---|
| Quantum of financial provision | Annually |
| Annual rehabilitation plan | Annually |
| Environmental audit report on approved EMPr and other environmental authorisations | Biennially or as per auditing timeframe indicated in authorisation(s) |
| Surface water monitoring reports | As per IWUL |
| Groundwater monitoring reports | As per IWUL |
| Dust monitoring reports | Annually |
| Noise monitoring reports | Annually |

# 2 Undertaking

The EAP herewith confirms

- the correctness of the information provided in the reports ☒
- the inclusion of comments and inputs from stakeholders and I&APs ; ☐
- the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and
- the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed; ☒

30 May 2023

**Signature of EAP** **Date**

# 3 Declaration of independence

Shangoni hereby declares that it is an independent EAP has no business, financial, personal or other interest in this project in respect of which Shangoni is appointed. Furthermore, no circumstances exist that may compromise the objectivity of Shangoni, excluding fair remuneration for work performed in connection with this project.

| | | | |
|---|---|---|---|
| **Report compiled by:** | **DRAFT FOR REVIEW** | **Report reviewed by:** | **DRAFT FOR REVIEW** |
| | **Lee-Anne Fellowes** | | **Ashley Miller** |
| | **(Registered EAP and Pr.Sci. Nat)** | | |